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One Billion Conversations.

The figures of the annual report of the American Bell Telephone Company are quoted in our columns this week, and give a very impressive idea of telephonic activities in this country. Eighteen years of steady development have made the telephone one of the foremost means of intercommunication, and the end of growth is not yet. Daily averages show that over the Bell system alone, no fewer than 1,231,000,000 conversations are held yearly. In other words, taking the population of the country at 75,000,000 that would give 17 uses per capita per year. This is many times the use of the telegraph, and may, perhaps, approximate the number of times each inhabitant uses a trolley car or steam railroad. With the rapid growth of telephony now going on, these figures will, however, soon become insignificant. We note that the report does not touch questions of policy such as the rumored removal of the company to New York and a change of the basis of capitalization.

The General Electric-Westinghouse Agreement.

The electrical business may not stand alone in curious changes of front, but it certainly is remarkable in the frequent perplexity caused by varying conditions in its field. For example, the Edison Company of New York, has for years been regarded as a leading advocate of low tension direct current work, yet in the last week or two its desire to operate multiphase high tension apparatus has precipitated between the Westinghouse and General Electric Companies, a legal contention that was hardly to be expected. The "patent agreement" between the parent companies protects the sub-companies, and that being the case, the United Electric Light and Power Company in New York, as the licensee of the Westinghouse Company has, it is asserted, rights to the exclusive use of multiphase apparatus that cannot be ignored. A knotty complication might arise if the courts were to decide that the General Electric Company could not furnish the apparatus, and if the Westinghouse Company, in deference to its licensee declined to do so. What would happen then?

A New Way to Pay Old Debts.

Out in Kansas they have developed many original ideas, but surely none is more unique than that by which it is proposed to avoid the burden of old indebtedness incurred by various municipalities. The plan presupposes the existence of some prairie primeval still open for occupation, and would hardly work in the East, where the supply of prairie ran short many years ago. A typical example is Attica, which having invested in various municipal enterprises, woke up one morning to find itself bankrupt, with a bonded debt of $33,000. It is sometimes said cynically that the creditor has to do all the walking, in chasing up his debtor; but this time the debtor proposed to indulge in pedestrianism. The Attica scheme, as sweetly simple as the 3 per cent. consols, is to leave the old town behind, and move across the prairie to another site. The debt attaches to the Attica that was, while the Atticans, like the Arab who folded his tent and stole away in silence, start out afresh a mile or two away, and can grow up with the country, unburdened by obligations, such as municipal bonds for electric light plants, sugar works, and central creameries. The sheriff may come down as a wolf on the fold, and the poor bondholder may cry aloud for his own, but of what avail?

From Kansas to Massachusetts is a far cry, but there is a warning

in the Attica episode for those who are so eager to encourage the spending of money on municipal plants. The schemes that a community can go into are endless, those out of which it can make money remain very few. We have just received the annual report of the Gas and Electric Light Commissioners of Massachusetts, from which it appears that no fewer than 211 towns and cities in the State reported official action as to a municipal gas or electric light plant, the number actually including all the places over 1500 inhabitants. The inference would naturally be that the private local companies are making outrageous profit. But when we turn to the painfully detailed records of the Commission we find that of the 66 companies supplying electric light, 32 are not paying dividends and five did not earn their expenses. These are not encouraging statistics, and we fail to discover the incentive upon which the 211 communities acted. Why they should look backward with Bellamy instead of forward with Atkinson is a mystery, especially as they have no final outlet of escape in a boundless prairie where every solemn pledge and promise can be gaily forgotten.

When Did Franklin Try the Kite Experiment?

An extended search through early electrical literature has failed to bring to light the date when Franklin tried the celebrated kite experiment which is so often pictured. It appears that in 1748, Franklin first had his attention drawn to the identity of lightning and electricity, though this subject had been discussed previously by others, notably by Abbe Nollet. In 1750, his celebrated letter to Collinson was published by the Royal Society, in which letter he gave very precise indications for an experiment to draw lightning from the clouds by means of a pointed rod erected on a high building. The experiment itself was apparently first performed in France by Dalibard, the date being May 10, 1752. The nearest indication to the time when Franklin was supposed to have performed his kite experiment is "early in the summer of 1752." Early in July, the same year, De Romas in France drew electricity from the clouds by means of a kite, and French writers claim that he was the first to do so, as no account of Franklin's early summer experiment could have reached Europe by that date.

In a letter dated Oct. 19, 1752, Franklin gives a description of the kite experiment. The letter states that "as frequent mention is made in the public papers from Europe of the success of the Philadelphia experiments for drawing electric fire from clouds by means of pointed rods of iron erected on high buildings, etc., it may be agreeable to the curious to be informed that the same experiment has succeeded in Philadelphia, though made in a different and more easy manner." A description follows, but written in the present tense in the form of instructions for making the kite and performing the desired experiment, in this respect being similar to the directions given in the Collinson letter for drawing lightning from the clouds by means of a high pointed rod. Did Franklin himself perform the experiment referred to in the quotation, and if so, at what date? This is not intended as an iconoclastic suggestion, but merely to determine a very interesting matter.

Fuses for High Tension Lines.

With the introduction of high voltages on transmission lines, a problem in connection with fuses was encountered, and it is interesting to note the manner in which it has thus far been met. On the new Southern California transmission line, employing 33,000 volts, the fuses are of pure aluminum wire, and for the loads of this particular installation are of No. 20 A. W. G. They are 3 feet in length, run through wooden tubes, on the ends of which are mounted switch knives fitted to slip into clips on the face of the board, so that the tubes may be removed for re-fusing. With such high pressures great care must be taken to prevent the current from establishing an arc, even with circuit-breaking devices giving an opening of great length. On another plant with a line pressure of 10,000 volts, aluminum fuses are also used, being about a foot in length, stretched horizontally and surrounded by soft-rubber tubes. On the melting of the fuse the weight of the soft rubber carries away the molten metal, giving a clean break. Another plant using 20,000 volts is fitted with enclosed fuses of a well-known standard make 15 inches in length. Still others use fuses of what are known as the expulsion type, in which the gases are confined and made to blow the arc, which may form out laterally, the terminals being instantaneously pulled apart by springs the instant the fuse melts. Aluminum seems to be the metal generally favored for the construction of such high-tension fuses.

Where very large powers, as well as high voltages, are to be broken, circuit breakers are preferred. Early types of such breakers were built with very wide openings, running up in certain instances to 6 feet. Later types are almost invariably made of the shunted-fuse type. In these the breakers themselves give a comparatively short opening, but the break is shunted by a fuse of aluminum or fine copper wire, generally enclosed in a vulcanized fibre tube. These fuses only carry the current when the breakers are opened, and are made of a carrying capacity much smaller than that which operates the devices, so that when the current is thrown on to the fuses they are enormously overloaded and blow out with a violence which leaves no material for the arc to work upon. The momentary carrying of the current by the fuse allows the breaker contacts to get a short distance apart without an arc, which, of course, cannot jump the clear air opening once established.

Advanced Class of Engineering Work.

One of the reasons why in the early days of electrical engineering, progress was more rapid in this country than abroad, was undoubtedly that while the foreigner was calculating, estimating and thinking, the American simply "cut and tried" until something of use was accomplished. The result was that while our extremely careful, thorough and theoretical cousins abroad were still thinking, calculating and estimating, the electric light, the motor and the trolley were becoming quite common, every-day sights here. Such a crude method, no doubt, has its advantages, especially when a new industry is started, as a contrast between early progress here and abroad has shown, but this method should not mislead one, and cause him to overlook the advantages of the slower but more thorough methods used by the foreign engineers, more especially the patient German. Long, tedious calculations and mathematical investigations may seem useless to many so-called practical men, but now that the industry has developed, competition is closer, and success will depend more and more on those refinements in design and construction which can be arrived at only by that kind of thorough investigation, be it mathematical or experimental research, which only the more highly educated engineers are capable of making.

This, in fact, is the real field for the engineer who has a more advanced education, and in our present competition with the foreigner in his own country, such work on the part of our engineers is becoming more and more important if we hope to continue our present satisfactory export trade in electrical apparatus. Unless our engineers are enabled to compete with the patient and plodding foreigners in this higher class of engineering work, we may find in course of time that all that the foreigner wanted was a set of the best samples of our goods, and having these to start with he will improve them by making the closer refinements which only the more advanced kind of research will develop. That we have in this country engineers of the highest class, no one will doubt, and many of them have the advantage over the foreigner in possessing a very

wide experience with the best class of electrical work. Unfortunately, however, those who hold the purse strings often do not appreciate the value of such advanced work, and object to a well-paid engineer taking up his valuable time with what seems to them to be "mere scientific research" or useless mathematics. It is the capitalist rather than the engineer who creates the unfavorable condition. Where an immediate return for money expended is the leading principle, a slower return from a more thorough class of work is not appreciated. Our rapidly growing export trade of electrical machinery now brings us into more direct competition with the foreigners, and we should be prepared to compete with them also in that higher class of engineering research which is appreciated so much more abroad than it is here. Some of our companies have recognized the value of this, and it is these companies which are now enjoying the benefit of an export trade.

Transmission of Alternating-Current Waves Over Long Circuits.

The subject of the transmission of long electrical waves over alternating-current circuits has received an additional stimulus from the paper read by Prof. Pupin last week, before the American Institute of Electrical Engineers. Up to the present time, electrical engineers have been compelled to content themselves with observing what happened at the two ends of a circuit, when alternating-current energy was transmitted over it; although from the observed terminal effects, aided by the general theory of the subject, it has been possible to compute the conditions which would result at any intermediate point of the line. Prof. Pupin has, however, prepared an artificial line, combining resistance, inductance and capacity electrically representing a real circuit some hundreds of miles in length, and by applying an alternator to the sending end, has been able to study the rise and fall of current and pressure along the circuit from point to point. The experimental results given in Dr. Pupin's paper are interesting and important as being in corroboration of the mathematical theory of alternating-current transmission over lines containing resistance, inductance and capacity. There is really very little that is new in the paper, from a mathematical standpoint, because the matter has already been worked out by a number of mathematicians, but the paper is important as furnishing a long-desired experimental proof of the accuracy of previously existing computations.

Artificial lines have long been known in connection with telegraphy, and many are in constant commercial use in connection with duplex and quadruplex telegraphy. In connection with land lines, or continental telegraph circuits, these artificial lines are comparatively crude and are only very rough electric copies of the circuits to which they are applied. In the case of long submarine cables, however, a greater degree of refinement has been rendered necessary, and, for duplex circuits, thousands of miles of artificial cable are in use, in which the resistance and capacity of the artificial line are distributed as completely as in the actual cable. Many experimental researches have been made with these artificial lines, and the current and pressure have been determined at various intermediate points for all kinds of terminal conditions. Such artificial submarine cables are never constructed to stand a high electric pressure, since 30 volts is regarded as a relatively high signaling pressure. Moreover, they possess only conductor resistance and electrostatic capacity, and are practically devoid of leakage and inductance.

Under such conditions, it is well known that when a simple alternating e. m. f. is applied at the sending end of the line, the pressure and the current diminish steadily and continuously along the line, according to a simple logarithmic law. When the line is very long, so that the wave reflections from the distant end are very feeble, it is known that the pressure or current diminish in amplitude by 63.2 per cent. in the distance within which the capacity reactance is double the conductor resistance. In the case of the frequency of 300 periods per second, which is commonly considered as an average telephonic frequency, this distance would be about a dozen nautical miles of ordinary submarine cable, and a telephonic current of this frequency would fall to less than 2 per cent. of its initial strength in four such distances, or in 48 nautical miles. An artificial power-transmission line is, however, a device of recent development, and that which exists at Columbia College seems to be the first of any considerable length which has yet been subjected to experiment. It differs from the old artificial telegraph line by the additional introduction of properly adjusted distributed inductance.

The effect of adding the inductance to the line introduces stationary waves, or so-called resonance-waves, into the circuit, so that the pressure and the current no longer steadily decline from the sending toward the receiving end, but rise and fall in regular succession, the current strength being a maximum at those points of the line where the pressure is a minimum and vice versa. These stationary waves or fluctuations are ordinarily very feeble in alternating-current circuits employing the frequencies of power transmission, but they must be markedly developed at telephonic frequencies. The effect of properly assorted inductance is to sustain the current and pressure in a marked degree; or, in other words, to keep the current from being absorbed by the capacity. The measurements reported in Prof. Pupin's paper upon an artificial line approximately representing a long-distance telephone line, show very marked successive elevations and depressions in current and pressure. By measuring the electric distance between any successive pair of these stationary wave crests or wave troughs, and multiplying by the frequency of the alternating current, the speed of transmission of the alternating-current waves over the equivalent real circuit is obtained. It appears to have been about 150,000 miles per second in some of the experiments.

As was pointed out, however, in the discussion which followed the paper, this speed is not the speed of the propagation of electricity or of the disturbances which culminate in the production of these stationary waves, but is the speed of development of alternating-current waves around the circuit when the stationary state has been attained; so that, whereas the speed of transmitting electric disturbances over the circuit is the speed of long-wave light through the dielectric, and is altogether independent of the frequency, the speed of these waves around the circuit varies directly with the square root of the frequency. The experimental results are of great importance as demonstrating the wonderful influence which inductance distributed in a circuit may have in counteracting the influence of distributed capacity and in maintaining the pressure and strength of current at considerable distances from the point of generation.

Another important corollary to be deduced from the experiments is the absence of all apparent theoretical basis for the so-called "KR law" of telephony, which states that the product of the total capacity and total resistance of a telephonic circuit cannot, in practice, exceed a certain numerical limit. The KR law undoubtedly applies to submarine telegraph cables in which the leakage conductance bears but a small ratio to the capacity reactance, and the resistance a large ratio to the inductance reactance. The KR law, or, as it becomes, under the proposed International notation, the CR law, was established by the observations and calculations of Lord Kelvin more than 30 years ago. But the CR law cannot apply to circuits such as those employed in telephony, in which the ratio of conductor resistance to inductance reactance is small, in combination with a relatively small capacity. Both theory and practical experience have long been in direct opposition to the CR telephonic law, and experimental measurement must now rank itself on the side of theory. The basis for a scientific theory of the limits of long-distance telephony, is now well established.

Judicial Interpretation Sought of the General Electric-Westinghouse Agreement.

Suit was begun in the Circuit Court of the United States, at Utica, for the northern district of New York, last week, by the Westinghouse Electric and Manufacturing Company to enjoin the General Electric Company from delivering to the Edison Electric Illuminating Company of New York City, multiphase apparatus and rotary transformers covered by Tesla patents controlled by the Westinghouse Company. Both companies maintain that the differences have their origin solely in the varied interpretation of the contract entered into in 1896 between the companies providing for an exchange of licenses. Three years ago this month the companies entered into an agreement to allow each other to use their several patents under conditions restrictive of territory and customers. The allegation of the Westinghouse Company is that the General Electric Company has violated the terms of this agreement by contracting to furnish the Edison Electric Illuminating Company with the multiphase apparatus whereas the United Electric Light and Power Company of New York City is the exclusive licensee of the right to use this apparatus.

The General Electric Company maintains that a different interpretation of the agreement allows it to supply these generators to the Edison Company. It declares that it has sold such generators to the Edison Company before, it being a matter of common knowledge that these machines are now in use on the Edison circuits. The value set on the apparatus in dispute is given in the bill of complaint at $250,000. The "patent agreement" between the two companies provides for a practically perpetual interchange of patent rights and licenses, but it is understood that the agreement protects fully the rights of the subsidiary licensee companies, such as the United Company in New York City.

Commercial Cable Company's West Indian Application Denied.

Attorney General Griggs gave an opinion last week on the application of the Commercial Cable Company for permission to land a submarine cable in Cuba and Puerto Rico, holding that the right could not be granted. The decision is based both upon the position of the executive branch of the Government and the declaration of Congress in the Foraker amendment to the Army Appropriation bill of the last session. Mr. Griggs says: "In all instances, heretofore, where applications have been made to this Government for grants or concessions, the executive departments have taken the ground that, in view of the fact that it is the declared purpose of the United States when a stable government shall have been established in Cuba, to retire from the island and leave the government thereof to the inhabitants, it would be inexpedient to grant such applications except in case of absolute necessity."

With reference to the landing of the cable in Puerto Rico he says: "Inasmuch as the permission to land its cable upon the soil of Puerto Rico seems to depend upon the grant of a similar right as to the island of Cuba, the same order should be made with reference to that part of the application.

"The conclusion which I have arrived at renders it unnecessary for me to discuss or decide the objections raised on behalf of the Western Union Telegraph Company, lessee of the International Cable Company of New York, which companies claim an exclusive grant under a concession from Spain, made in 1867, which exclusive grant, it is claimed, has not yet expired."

Alleged Consolidation of Independent Telephone Companies.

A special despatch from Chicago of March 22 says: Independent telephone manufacturing interests have organized to fight the Bell company with a trust of their own. At a secret session this afternoon the ways were greased for the launching of a $7,000,000 combine. W. T. Blaine, vice-president of the Victor Telephone Manufacturing Company, of this city, is in charge as promoter-in-chief. It is represented that options are in hand or in prospect for 90 per cent. of the factories producing "independent" apparatus. Details as to the plants this includes, as well as the sources from which the capital for their acquisition is to come, are zealously guarded, but the names of John J. Mitchell, president of the Illinois Trust and Savings Bank, Assistant United States Treasurer William P. Williams, and Mr. Merigold, a New York banker, are mentioned as the financial sponsors of the deal.

Mr. Blaine's plans are reported to embrace the combining among others of the following concerns: American Electric Telephone Company, Chicago; Victor Telephone Manufacturing Company, Chicago; Western Telephone Construction Company, Chicago; Keystone Electric Telephone Company, Pittsburg; Reliable Electric Manufacturing Company, Worcester, Mass.; Mason Telephone Pay Station Company, Ludington, Mich.; Williams Electric Company, Cleveland; Northwestern Electric Telephone Company, Milwaukee, Wis.; Sterling Electric Company, Chicago; Stromberg-Carlson Telephone Manufacturing Company, Chicago; Farr Telephone and Construction Company, Chicago; Viaduct Manufacturing Company, Baltimore, Md.; Eureka Electric Company, Chicago; Butler-Taylor Company, Ravenna, O.; National Automatic Telephone Company, Chicago, and Central Telephone and Electric Company, St. Louis, Mo. It is declared that one of the most influential factories outside of the Bell breastworks—the Kellogg Switchboard and Supply Company, of Chicago—has thus far resisted all overtures to join the combine.

The Electric Lighting Statistics of Massachusetts.

Through the courtesy of Mr. F. E. Barker, one of the members, we have received the fourteenth annual report of the Board of Gas and Electric Light Commissioners of Massachusetts. Previous reports have attested the value of the document, which has few, if any, compeers. The plan of control adopted in Massachusetts for this class of service is analogous to that prevalent in many States for the supervision of railroads, and further developments in this direction may be expected. The example of the Bay State is therefore well worthy of study, and the report presents as usual many points of general interest.

It appears that there are now under the supervision of the board 138 companies and the gas or electric light plants of fourteen towns and two cities. Of the companies, forty-six are engaged in the supply of gas only, twenty-four in the supply of both gas and electric light and sixty-eight supply only electric light. Of the municipalities two have plants for the supply of gas and electricity, the others supply only electric light. As to the electric light companies, it is stated that five do not appear to have earned their expenses and thirty-two others had not earned enough to warrant the declaration of any dividend. In spite of this, 211 communities agitated the subject of a municipal electrical plant, but of these 181 took no action during the year. Among the companies paying a dividend, the rate ranged from 2 per cent. at Grafton to 12 per cent. at Natick.

The following table shows the number of electric lights of various candle powers which represent the electric lighting capacity of all the companies June 30, 1895, 1896, 1897 and 1898:—

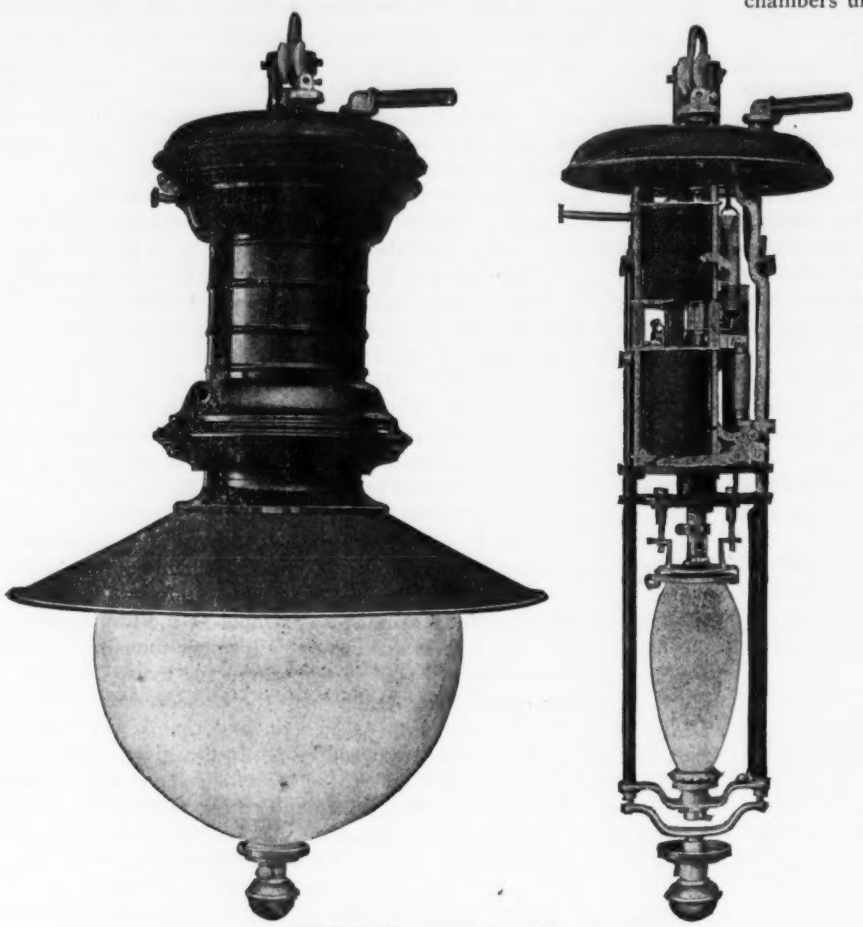
		1895.	1896.	1897.	1898.
10	candle-power	600	600	600	600
15	" "	836	836	836	836
16	" "	341,700	414,450	464,450	500,500
20	" "	2,400	2,400	2,400	800
4000	" "	....	6	6	6
2000	" "	11,608	12,113	12,579	13,529
1200	" "	10,682	11,522	12,622	14,450
1600	" "	160	160	160	160
1500	" "	60	35	35	35
800	" "	70	70	70	70

As to electric power, a computation based on the data in the report would show that 10 motors were in use on arc circuits; 2775 on incandescent circuits; 2235 on power circuits, and that these motors represented a total of 18,931-hp of current.

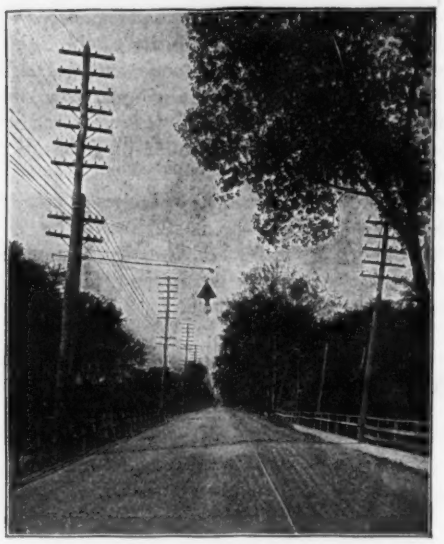
The returns from the municipal electric light plants of the state showed receipts of $88,181 and expenses of $150,536, or a loss on operating of $62,354, which, with interest, depreciation, etc., left as the cost of town and city lighting, the sum of $149,941. The gas companies engaged in electric lighting to the number of 17, had investments therein to the extent of $1,158,090. The price for current ranged from 25 cents down to 10 cents per kilowatt hour, with discounts up to 50 per cent. for large quantities at the higher price. An endless variety of practices prevail as to charge for wiring, renewals, minimum and maximum charges, hours of lighting, etc.

Alternating Current Series Arc Lighting, Hartford, Conn.

THE enclosed arc lamp is particularly adapted to outdoor illumination, and has been used with much success on constant-potential circuits for that purpose. Recently the Hartford Electric Light Company has installed these lamps operated in series on alternating-current circuits, which system presents a number of new and interesting features. The current is generated by water power on the Farmington River, twelve miles distant, transmitted to the Pearl Street station at a voltage of 10,000; there transformed to 2400 volts, and then passes through an underground feeder to the State Street station, where the constant-current transformer for the series arc circuit is located.



ALTERNATING CURRENT SERIES ARC LAMP.

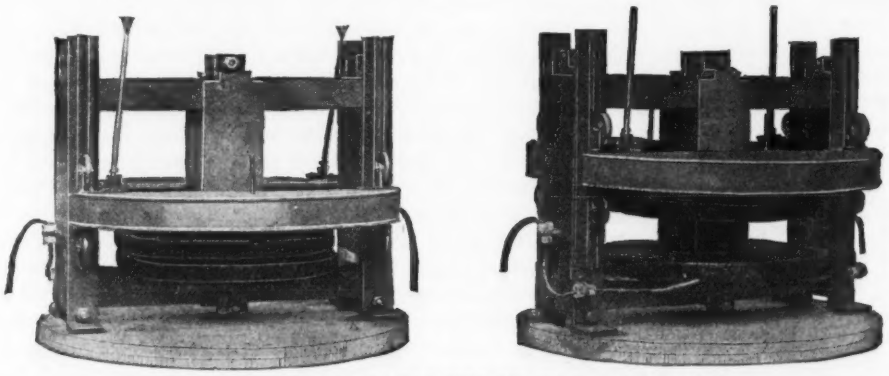


METHOD OF SUSPENDING LAMP.

The latter is a new type of transformer, though the principle upon which it is based was discussed by Prof. Elihu Thomson in a paper several years ago. It depends for its action on magnetic leakage, and is constructed with separate primary and secondary coils, one of which is movable while the other remains fixed. The weight of the movable coil is partially counterbalanced, so that at normal full current load, this coil lies in contact with the stationary coil, notwithstanding the magnetic repulsion between them. When, however, one or more lamps are cut out of the circuit, the increasing current increases the repulsion between the coils and separates them, thus reducing the current to normal. At no load, the distance between the coils is a maximum. The regulation is thus entir ly automatic and it is found that the transformer maintains a practically constant current.

This type of transformer for the alternating-current series system may be located in the station or in buildings in the vicinity of the circuits to be lighted, or they may be placed in street boxes or in chambers under the street and connected to the underground system in the usual way. It is stated that they require no attention after installation. They are now manufactured by the General Electric Company in capacities for 25, 50, 75 and 100 lamps. The actual range of regulation on the 60-cycle circuit is as follows: Transformer for 25 lamps, 7 to 25 lamps; 50-lamp transformer, 14 to 50 lamps; 75-lamp transformer, 21 to 75 lamps; 100-lamp transformer, 28 to 100 lamps.

The lamps used in connection with the above series alternating system are of the General Electric carbon-feed enclosed type. They operate at 60 cycles frequency, but may be adjusted for higher frequencies. The mechanism includes two magnets which are placed one above the other and exert forces in opposite direction on an H-shaped laminated armature connected to the carbon tube. The operation of the lamp is thus on the differential principle. The weight of the carbon and carbon tube is balanced by a spring so adjusted as to assist the series magnet in striking the arc at the proper voltage. A small starting resistance is provided as in all series arc lamps, and a mechanical cut-out is arranged to operate in case of accident to the carbons or an open circuit in the lamp. Vibrations of the armature core of the magnet are absorbed by small coiled springs. The feeding clutch is of the cam type, and is opened by a tripping table which also serves as a support for the enclosing globe cap when the globe is removed. The energy required at the lamp terminals is approximately 450 true watts, the voltage being 72 and



FULL LOAD AND HALF LOAD POSITION OF SECONDARY COILS.

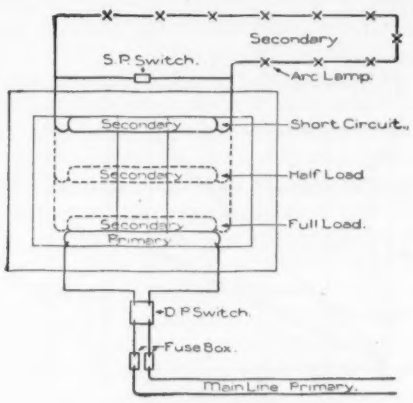


DIAGRAM OF CONNECTIONS.

the normal current 6.6 amperes. The loss in the lamp is about 25 true watts.

At Hartford the lamps are all used for street lighting and are hung 400 to 500 feet apart. The remainder of the installation which will soon be put in, consists of six transformers, each operating two circuits of 50 lamps each. They will replace open arc lamps now supplied with current by twelve generators of different types belted to shafting operated by a steam engine. The friction and belting losses are so large that the new system is said to indicate a saving in energy at the station amounting to 0.1-hp per lamp.

The series alternating system will enable companies transmitting power by alternating current generated at a distance, to run series arc circuits for street lighting without installing new transformer plants, and stations operating alternating-current generators can extend the service without adding other types of lamps or complicating the circuits with high-tension arc lamps. The use of enclosed arcs reduces largely the cost of lamp maintenance requiring trimming but once in eight to twelve days, while the carbon cost per lamp per trimming is approximately but 2½ cents. One trimmer will thus care for six to eight times as many lamps as formerly, and the annoyance to customers due to cleaning and trimming is correspondingly decreased.

Another advantage of the enclosed arc lamps is that diffusion from them is so efficient that the intensity of the light does not require to be diminished by a great distance between the lamp and the object to be illuminated, as in the case of open arcs. For municipal illumination, enclosed arc lamps with reflectors may be suspended in the middle of the street at a distance of from 18 to 20 feet from the ground.

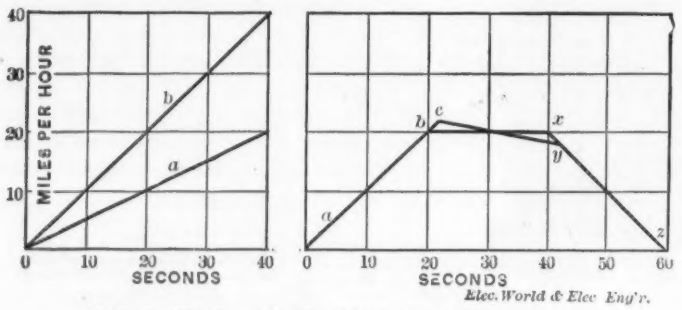
The length of the lamp is 29½ inches over all, and its weight 24½ pounds. The upper carbon is 9½ inches by ½ inch and the lower carbon 6 inches by ½ inch. The maximum diameter of the outer globe is 12 inches and of the inner globe 3 inches, the latter being 6½ inches high and the former 11½ inches.

The Cost of Speed in Rapid Transit Service.—I.

By J. R. Cravath.

IN the past two years we have come to look at the possibilities of electricity in performing a rapid transit service on elevated and steam suburban roads in somewhat of a new light. At first the predominant idea was to get electricity to perform the same service as steam, only to do it cheaper for the company and more pleasantly for the public. The question of performing a more rapid schedule than steam locomotives could perform was scarcely touched upon. In the past two years, however, the question of increasing the schedule speeds of elevated and suburban steam lines by the adoption of electricity has been brought forward by a number of causes, prominent among which may be mentioned the appearance of the Sprague multiple unit system, the results obtained from the electrical equipment of the New York, New Haven and Hartford Railroad, and the rapid acceleration principles laid down by John Lundie, consulting engineer for the Illinois Central and Brooklyn Elevated railroads.

The possibilities of increasing schedule speeds by the use of elec-



FIGS. 1 AND 2.—ACCELERATION AND SPEED CURVES.

tricity are in many cases very great, and it is worth while for all companies owning rapid transit lines to inquire into what can be done in this direction and also what it will cost. It is the purpose of this article to make a very limited investigation of the relative cost of various schedule speeds under a given set of conditions. In order to make any fair comparisons a fixed set of conditions must be assumed and all calculations based upon those conditions. Consequently, we will assume that the distance between stations is 2000 feet in all the following calculations and that the station stops are 10 seconds in duration. This is near the average of conditions to be met on elevated roads in this country. It should be borne in mind that whatever is said in this article relates not to the cost of various schedule speeds with an equipment already in operation, but is intended to arrive at relative costs of various schedules with an equipment designed in each case for the schedule. This is a very different problem from changing the schedule with a fixed equipment which may be limited by the speed of the motors, their capacity, and other things. Before stating further the conditions that I assume it will not be out of place to lay down briefly the principles that both experience and theory have taught us to be correct in the plans for such a rapid transit service. The speed curve for such a service consists of three parts, as follows:

First—Acceleration up to a certain maximum speed.

Second—A period of time, however short, between the time maximum speed is attained and the time brakes are applied, and during which time the motors may be either coasting with current off or running with current on to overcome the train friction only.

Third—Retardation or braking, during which time the energy stored up in the train by acceleration is wasted in the brake shoes to bring the train to rest.

Now, it is evident that if it is required to run, say, 2000 feet in a given time, the faster the acceleration the less will be the maximum speed necessary to run the distance in that time and the less the energy that must be wasted in the brakes at the end of the run. The energy wasted in the brake shoes varies according to the square of the velocity of the train at the time brakes are applied. The first principle that must be laid down, then, in the plans of our rapid transit line is that for the sake of economy in mechanical energy the accceleration must be as rapid as the traction of the driving wheels will permit, making due allowance for slippery track and imperfect methods of applying power to the motors. There is also a further economical reason why the acceleration should be rapid to keep the maximum speed low, and that is that with an electric motor the current required to produce a given acceleration varies directly according to the speed for which the motor is wound or geared. A motor wound to run 40 miles an hour with a given train wlil take double the current to accelerate a certain train at a given rate than a similar motor wound to run 20 miles an hour will take to accelerate the same train at the same rate. This shows the importance of having motors wound to run as slow as the proposed schedule will permit, and this fact has been forgotten by very many electric railway companies in the purchase of equipments. Not only is there nothing gained by having fast motors and slowing down the rate of acceleration so as to make the same schedule speed as with slower motors, but there is a loss, and a large one, too. No electric road with frequent stops and employing an acceleration very much below the slipping point of the driving wheels but could make the same schedule and economize power by gearing its motors down or rewinding them so as to get a lower maximum speed and employing an acceleration nearer the limit of driving wheel traction. The heating of the motors is not in this way increased and the current required considerably decreased.

To illustrate this point more fully, I show two acceleration curves diagrammatically in Fig. 1. The line *a* represents an acceleration only one-half as great as in curve *b* for the same train weight, yet the current or energy input is the same in both cases because the motor which produces *a* is wound for double the speed of the one producing the rapid acceleration shown in curve *b*. The actual energy is the same in both cases, because the current time and voltage are the same, and yet the practical useful result is that the train has only attained half the speed with the fast motor that it has with the slow motor in the same length of time. The commercial efficiency is 50 per cent. lower with the high-speed motor for the period of acceleration shown. The difference, of course, is due to the fact that the horizontal effort per ampere in the fast motor is only half that in the slow. The power not turned into useful work in curve *a* is accounted for by the loss in the rheostat.

Having fixed the acceleration question, we come to that part of our speed curve after the train is brought up to speed, and here comes the problem of whether it is better to get the train up to maximum speed and then let it drift or coast with current off before applying the brakes or whether it is best to bring the train up to a slightly lower maximum speed and then run along at that constant maximum speed with the current on until time to apply the

brakes. As to this, both theory and practice have answered in favor of the coasting method as far as electrical energy used at the train is concerned. The theory can be understood easily by an inspection of the already familiar speed diagram shown as Fig. 2. If this speed diagram had some of the sharp corners knocked off I could truthfully call it a speed curve, but as it is, it is more convenient to show the mathematical principles involved than an actual curve would be. In this diagram the line *a b* represents the acceleration with the lower speed motors, the line *b x* represents the period of constant running at maximum speed, and the line *x z* represents the retarding or braking period. The area enclosed by this speed diagram represents the distance covered. Suppose, now, we cover the same distance (enclose the same area) in the same time by accelerating until we reach a higher maximum speed, as shown by the line *a c;* then shut off current and allow the train to coast until the point *y* is reached, and then brake on the line *y z* at the same rate as in the other case. Now, as the distance covered must be the same in both cases since the areas enclosed are the same, the schedule speed must be the same. The mechanical energy required at the car axle to make the run *a c y z* is less than to make the run *a b x z* for the simple reason that the braking begins at a lower speed in the first case than in the second and therefore less energy is wasted in the brake shoes. Furthermore, the electrical energy required by the motors will be less to make the coasting run, because, as an inspection of the characteristic curve of any railway motor will show, the efficiency of the motors when working on as light a load as simply overcoming the resistance of the train is exceedingly low, so that for this reason also it is best to shut off current ordinarily as soon as acceleration is over. There is one thing which must be considered about the coasting method, however, ever, which is that it requires a higher starting current on account of the higher speed of the motors necessary to make the same schedule with it.

In the following calculations I have thought it best to make all speed and current curves on the assumption that the coasting method is not used, but that the current is kept on until time to apply the brakes; not because that practice is to be advocated, but because, as a matter of fact, during rush hours and making up time, that will be done to a large extent, and if calculations are made on that basis it will be easy to separate the current used during acceleration from that used after, and we can thus determine about what the efficiency would be in practice with the coasting method. In other words, the estimates will first be made on the fastest rush-hour schedule that can be maintained with stations 2000 feet apart and 10-second station stops, and then deductions can be made as to the probable performance with a slightly slower schedule, lighter loads, shorter stops and the coasting method in place of the constant maximum speed method of operation.

As the weight of train on the drivers has an important bearing on all rapid transit schedules, I will consider three classes of electrical equipment, as follows:

First—Four-car elevated trains with a motor car at the head of the train.

Second—Four-car elevated trains with half the axles on the train motor driven as in the multiple unit system.

Third—Four-car elevated trains with all the axles motor driven on the multiple unit system.

The maximum horizontal effort that a motor car or locomotive can exert on a dry track is usually accepted to be one-fourth the weight on the drivers, or 500 pounds per ton on the drivers. To allow for slippery track and for a certain amount of unavoidable unevenness in the way the current is applied to the motors a liberal deduction must be made from this figure to arrive at something that can safely be counted on for every-day practice. I will therefore assume that 350 pounds per ton on the drivers can be counted on, since emergency brake tests as well as a number of acceleration tests seem to show this is a safe figure.

Taking up the first case, I will assume that the three trail cars of our four-car train weigh loaded 42,000 pounds, being about the usual elevated type. I will also take the weight of the motor car loaded with trucks and everything but motors and controlling apparatus as 46,000 pounds. The weight of the motors necessary will depend on the schedule time to be made, and as the amount of loading a given size of motor will stand is largely a matter to be determined by experience, it will be best to take the results of experience in that line as a basis. As nearly as I can determine from the experience of the elevated roads in Chicago which have been in operation some time it is best to count on a motor equipment weighing not less than 18,000 pounds complete with controllers, resistances, air-brake apparatus and all electrical appurtenances; this for stations 2000 fet apart and schedules of about 14 miles per hor, with four-car trains. This is about the weight of equipment recently adopted, and as experience is a good teacher, we will accept the above weight of motors for our first calculation. The motor car will then weigh 23 tons plus the 9 tons weight of the motors, or 32 tons. Adding to this three trailers of 21 tons each gives a total loaded train weight of 95 tons. With 32 tons on the drivers (supposing that the motor car has a motor on each axle) and an available tractive effort of 350 pounds per ton, less 20 pounds per ton to allow for the friction of the motor icar, the horizontal effort available for train acceleration would be 10,560 pounds at the motor car drawbar. In order to get the actual pounds available for acceleration of the train a deduction must be made from this to allow for trail car friction, for which 15 pounds per ton of trailer is probably a fair figure, and is at least not too high. The friction of the 63 tons of trailers at 15 pounds per ton would then be 945 pounds, which figure deducted from the 10,560 pounds at motor car drawbar would give 9615 pounds, net horizontal effort available for the acceleration of the train, or 101.2 pounds per ton of train. From the familiar formula of mechanics

$$\text{Acceleration, feet per second} = 32.2 \times \frac{\text{Accelerating force, lbs.}}{\text{Weight, lbs.}}$$

the following formula, more convenient for present use, can be derived:

$$\text{Acceleration, miles per hour per second} = \frac{\text{Tractive effort, lbs. per ton}}{91.3}$$

By this formula a tractive effort of 101.2 pounds per ton will give an acceleration of 1.1 miles per hour per second. We can therefore

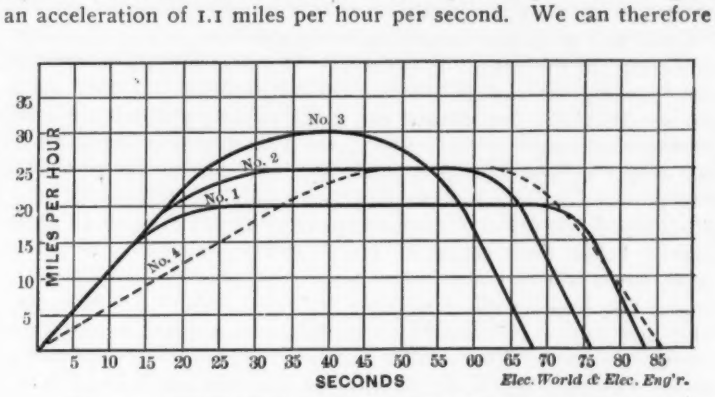


FIG. 3.—ACCELERATION CURVES, MOTOR CAR AND TRAILERS.

plot acceleration curves for this train on that basis. Curve 1 in Fig. 3 shows the acceleration curve of such a train with motors wound for a maximum speed of 20 miles per hour with a full loaded train. It is next necessary to see what rate of braking or retardation can be counted on. The practice of suburban and elevated lines varies greatly in this respect. Most of them could practice quicker stops than they do without discomfort to passengers, and it is in the interest of economy to do so for the same reason that rapid acceleration is desirable, as explained in the first part of this article. As the service stops of suburban and elvated roads vary from 90 pounds per ton retarding effort up to 475 pounds for emergency stops on electric roads there is evidently a wide range of data upon which to make assumptions. One naturally hesitates before saying that the practice of the majority of steam and elevated roads in regard to rate of braking could be improved, but in view of the desirability of quicker stops and the undoubted fact that they can be made in service I will base calculations for the present on a rate of 2 miles per hour per second corresponding to a retarding effort of 182.6 pounds per ton including friction. This is better than most roads are doing in service, but still far below the slipping point of wheels and no more rapid than emergency stops or service stops on some roads. Having fixed the acceleration and braking curves, we find that for a maximum speed of 20 miles per hour and a run of 2000 feet the speed curve will have the form shown in curve No. 1, Fig. 3. The time required to make this run, including a 10-second station stop, is 93.6 seconds. This corresponds to a speed of 14.5 miles per hour. It is evident that with a lighter load and shorter stop the motors could be allowed to

coast the greater part of the distance and still make the same schedule time.

Curve 2, Fig. 3, is a speed curve for conditions exactly the same as in curve 1 except that the maximum speed is 25 instead of 20 miles per hour. The time required for the run, including the stop of 10 seconds, is 86 seconds, corresponding to a speed of 15.8 miles per hour.

Curve 3, Fig. 3, is for the same set of conditions as 1 and 2 with the maximum speed raised to 30 miles per hour, resulting in a run of 77.7 seconds corresponding to a schedule speed of 17.5 miles per hour. This curve approaches very near the limit of what it is possible to do with this equipment, as will be seen by the fact that only five seconds elapse between the time maximum speed is attained and the time brakes are applied. It should be stated, however, that to simplify calculations no allowance has been made for the increased weight of the motors necessary for curves 2 and 3 and the very slight increase in the traction available for acceleration which would result therefrom.

Curve 4, Fig. 3, was plotted as an experiment to show the effect of placing the motors all on one truck of a double-truck motor car and reducing the rate of acceleration and braking. In this curve the weight of the motors and car is still taken as 32 tons, but by placing the motors on one truck only (motors weighing 9 tons) the weight on the drivers is made 20.5 tons only. The acceleration is taken as $^{8}/_{10}$ miles per hour per second corresponding to a gross tractive effort of 331 pounds per ton on the drivers. This is slightly below the traction of 350 pounds assumed for the other cases, but is still very near it and near actual practice at the present time. The braking effort is taken for this curve at 1.5 miles per hour per second, or nearer to actual present practice than the curves 1, 2 and 3. The result is a schedule speed of 14.2 miles per hour. This may be compared with curve 1, and the desirability of having much weight on the drivers is shown by the lower maximum speed at which the same schedule time can be made with curve 1 and the rapid acceleration permitted by the greater weight on the drivers. This will be discussed more fully later.

In order to raise the schedule speed still higher than in curve 3, Fig. 3, it is necesssary to increase the weight on the drivers, and the only practicable way to do this is to employ the multiple-unit system and make a greater number of the axles under a train drivers.

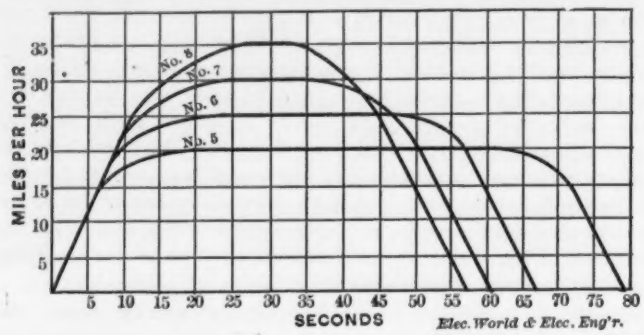
In Fig. 4 are a set of curves calculated for a multiple-unit train upon which half the axles of the train are motor driven. The weight of each car without motors is assumed to be 43,000 pounds, or 1000 pounds more than the trailers in the previous case, to allow for provisions for the electrical equipment of each car. The weight of two motors and auxiliary electrical appliances is taken at 7500 pounds, making the total weight of each car 50,500 pounds, or 25¼ tons. Supposing that by crowding of apparatus to the motor-truck end of the car 67 per cent. of the weight can be put on the drivers (a rather liberal supposition), and taking the former assumption of 20 pounds per ton for friction and 350 pounds per ton of weight on drivers for traction, an acceleration of 2.36 miles per hour per second can be obtained with this equipment. The curves in Fig. 4 are based on this rate of acceleration, and upon a braking effect of 2 miles per hour per second, as in former cases. No allowance is made for increase in motor weight with increased speeds.

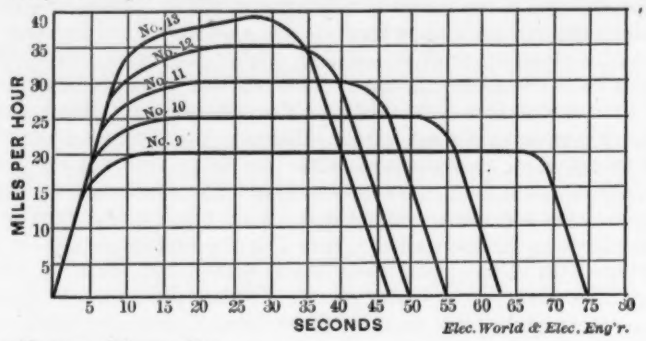
Curve 5, Fig. 4, is for a train attaining a maximum speed of 20 miles per hour with the rates of acceleration and braking just mentioned. The time of the run of 2000 feet, including a 10-second stop, is 89 seconds, corresponding to a speed of 15.3 miles per hour.

Curve 6 is for the same conditions except that 25 miles per hour is attained, and the run, including stop, is made in 77 seconds, corresponding to a speed of 17.7 miles per hour.

Curve 7 shows a maximum of 30 miles per hour, resulting in a run of 70.6 seconds on the basis of a schedule speed of 19.3 miles per hour.

Curve 8 comes near to the limit of schedule speed with this rate of acceleration and acquires a maximum speed of 35 miles per hour, which can only be maintained for a few seconds before the brakes must be applied. This run is made in 66.6 seconds and at a schedule of 20.4 miles per hour.





FIGS. 4 AND 5.—ACCELERATION CURVES, MOTOR CAR.

To get higher speeds than this, the rate of acceleration must again be increased by adding to the weight on the drivers; that is, by increasing the proportion of driven wheels under a train, and we must resort to a multiple-unit system with all four axles under each car equipped with motors. In this case the entire weight of the train is available for traction or 350 pounds per ton of train. Deducting 20 pounds per ton friction we have 330 pounds per ton for acceleration, which by our formula will give an acceleration of 3.6 miles per hour per second.

The curves 9, 10, 11, 12 and 13 in Fig. 5 are based on this rate of acceleration. As it is manifestly inconsistent to buy expensive apparatus to secure a high rate of acceleration and still leave the rate of braking where it was, at a much lower figure than the acceleration, I assume in the curves in Fig. 5 that the rate of braking is 3.0 miles per hour per second, which is still less than the rate of acceleration.

Curve 9 shows a maximum speed of 20 miles per hour, and the run of 2000 feet, including a 10-second stop, is made in 85 seconds, corresponding to a speed of 16 miles per hour.

Curve 10 shows a maximum speed of 25 miles per hour, and the run is made in 73 seconds, corresponding to a schedule speed of 18.6 miles per hour.

Curve 11 shows a maximum speed of 30 miles per hour, and the run is made in 65.6 seconds at a schedule speed of 20.7 miles per hour.

Curve 12 shows a maximum speed of 35 miles per hour, and the run is made in 60.4 seconds at a schedule of 22.5 miles per hour.

Curve 13 is the limit of practical attainment in fast schedules, and the train attains a speed of 39 miles per hour. Immediately upon attaining this speed brakes are applied and the run is made in 57.5 seconds, at a schedule of 23.7 miles per hour.

We have, then, in curves 1 to 13 inclusive a range of speed of from 14.2 to 23.7 miles per hour. Of course, this applies only to runs of 2000 feet, and in practice the time schedule would be considerably lower than the figures given, which are for the maximum schedule speed it is possible to make with 10-second stops.

In a final article the speed curves plotted for the various schedules and equipments will be used to determine approximately the relative electrical energy required for the diffrent cases to which the curves refer.

The Canadian Niagara Power Company's Monopoly.

The Ontario Government authorities and the Canadian Niagara Power Company have come to an agreement by which the company has decided to relinquish its monopoly before Nov. 1 next. The agreement provides that the company will continue to do business, but the monopoly clause will be stricken out. A second company is negotiating with the Government, and has about arrived at a definite agreement, the details alone not being arranged. When they have been settled work will be commenced at once.

Electricity in the Italian Navy—III.

By GIULIO MARTINEZ.

THE lessons of the recent naval engagements on the Yalu and at Cavite and Santiago, which teach the necessity of getting rid of all combustible material, will be applied in a quite new arrangement for the circuits on the Saint Bon. All mains are to be of bare copper wire insulated by porcelain and carried in iron pipes.

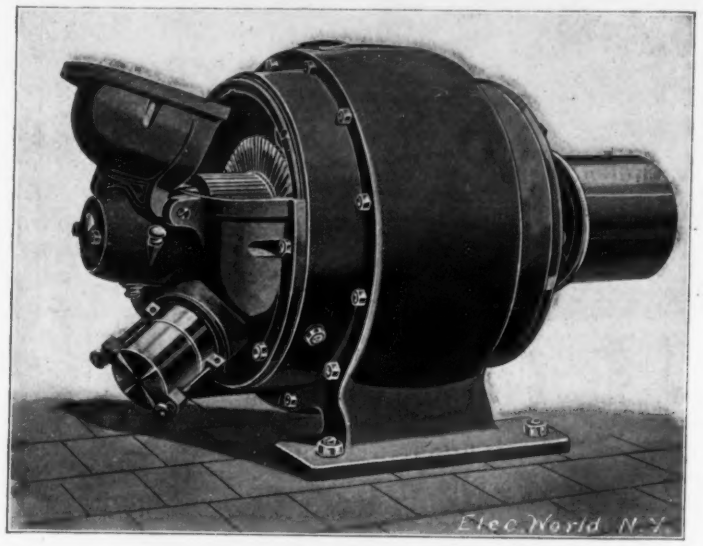


FIG. 12.—BRIOSCHI & FINZI MOTOR.

Branch circuits will be lead covered, and no wood mouldings will be used.

Considerable progress has been made in motor design, and an hermetically sealed type, made by Brioschi and Finzi, of Milan, has been adopted. There are three sizes in use, 2, 4 and 6-hp, but the 4-hp form is the most widely used. This motor is shown in Fig. 12. It has six poles for the 6-hp model and four poles for the 2 and 4-hp models. The shaft and the leads are fitted with stuffing boxes. Both field and armature cores are laminated, and are enclosed in a steel casing which supports the journal boxes.

The principal dimensions of the 4-hp model are given in Fig. 13; it weighs 286 pounds and runs at 1000 r. p. m.

Compound wound and series motors are the types mostly in use, the series wound motors driving ventilating fans. Some of the details of construction will doubtless be of interest. The armature of the 65-volt machine has a resistance of .026 ohms which comes up to .078 when measured at brushes, due to the effect of carbon brushes. The series motor has a resistance of .04 ohms in the series winding.

The armature winding is of the Andrews type, each coil composed of wire 0.118 inch in diameter, is removable and the current density at full load is about 2600 amp. per square inch. In the field coils the current density is 1900 amp. per square inch. After operating four hours under full load, the rise in temperature is 50° C. which permits of very heavy over loads provided they are intermittent.

The performance of this motor has been carefully studied with the aid of M. Pasqualini's electric brake, another model of which (see Fig. 17) of eight horse-power capacity is now in the possession of the laboratory at Spezzia. These tests are made as follows:

First, a series of readings are taken under constant load (produced by the electric brake), the speed being made to vary, by varying the impressed e. m. f. at the terminals. The current is practically constant for constant torque and the curve of variation of voltage with change of speed, is nearly a straight line. The results of several tests are given in Fig. 16.

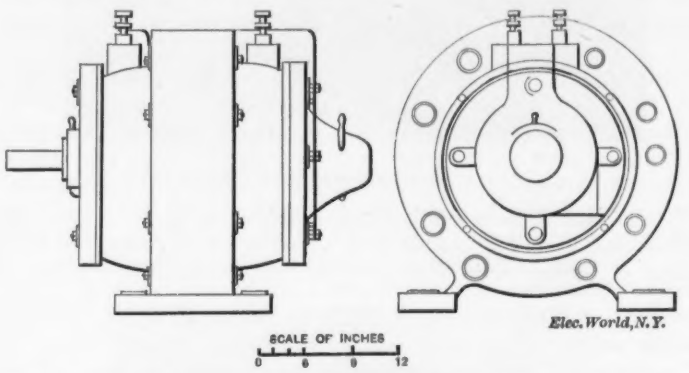
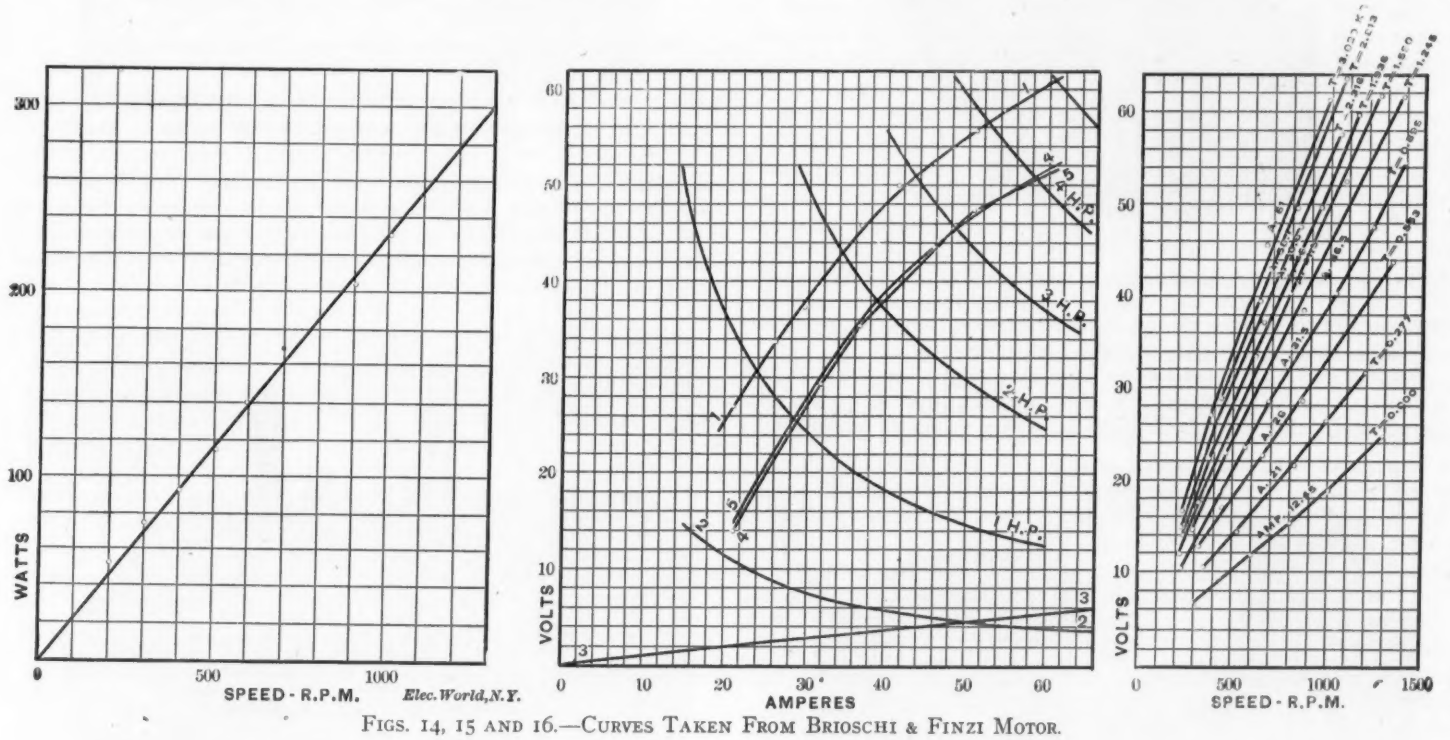


FIG. 13.—DIAGRAM SHOWING DIMENSIONS OF BRIOSCHI & FINZI MOTOR.

From this diagram, the characteristic curve of the motor can be deduced with great accuracy, whereas it would be hard to take such a curve directly from the motor, owing to the difficulty of keeping the speed constant. Curve 1 in Fig. 15 is the characteristic curve. If the $I^2 R$ losses be calculated, from the curve in Fig. 15 corresponding to zero torque, a curve for friction losses for varying speed may be plotted. (See Fig. 14). At 1000 r. p. m. the frictional losses absorb 230 watts, and are equilateral hyperbola whose equation is $X Y = 230$ will be the curve of volts lost in overcoming friction at different speeds. (See curve 2, Fig. 15.)

The volts lost in overcoming the resistance of the conductors are



FIGS. 14, 15 AND 16.—CURVES TAKEN FROM BRIOSCHI & FINZI MOTOR.

represented by the ordinates of a straight line (see curve 3, Fig. 15), inclined towards the axis of abscissae at an angle whose tangent is 0.09, which was the average value of the resistance during the tests (the rise of temperature being 35° C.)

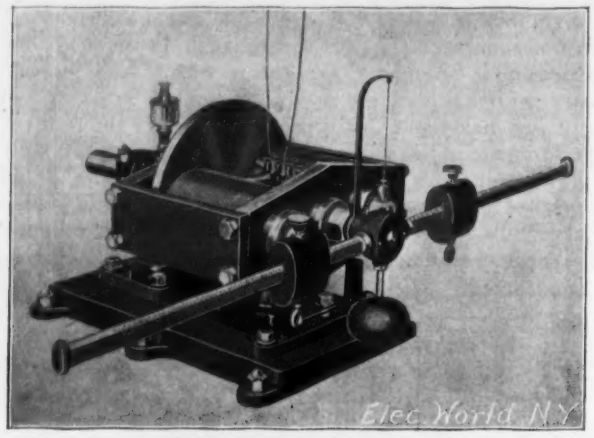


FIG. 17.—ELECTROMAGNETIC BRAKE.

If the sum of the corresponding ordinates of curves 2 and 3 be subtracted from the ordinates of curve 1, the result will be a curve of counter e. m. f. and the product of the abscissae by the

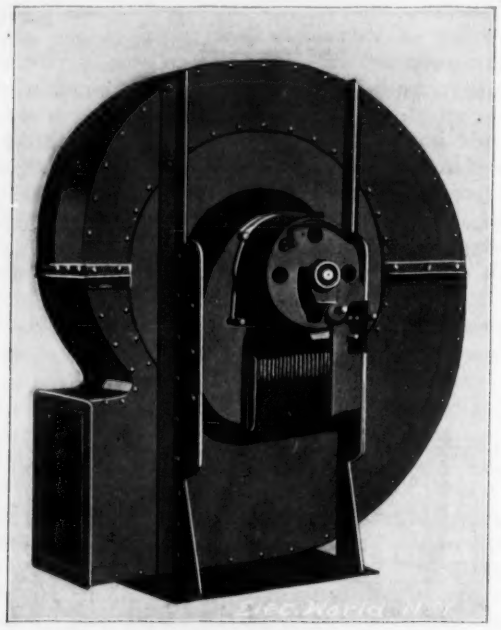


FIG. 19.—CENTRIFUGAL BLOWER OF THE SOC. NAZ. DI SAVIGLIANO.

ordinates of this curve will be the useful energy with the exception of what is absorbed by eddy currents and hysteresis.

But the useful output is known from the brake measurements, and a curve of useful output as obtained from the product of the corresponding values of current and the proper values of voltage, may

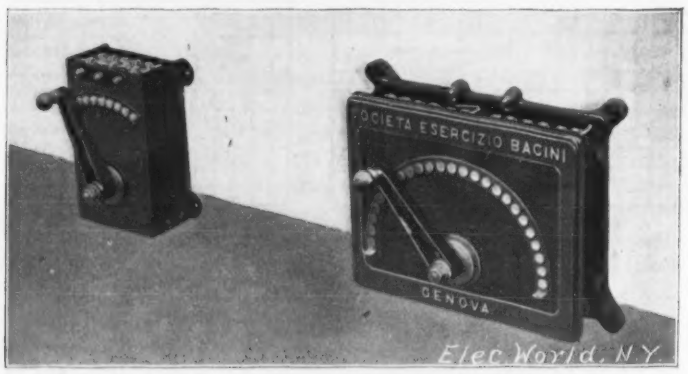


FIG. 21.—STARTING RHEOSTAT FOR BLOWER MOTOR.

be plotted for the speed of 1000 r. p. m. Curves 4 and 5 represent these values and from their practical coincidence it is evident that the eddy current and hysteresis losses are almost nil.

If the horse-power curves up to 5-hp be added to diagram 15, the efficiency of the motor at various loads can easily be ascertained. At the rated capacity of 4-hp at 1000 r. p. m. the input is 3480 watts

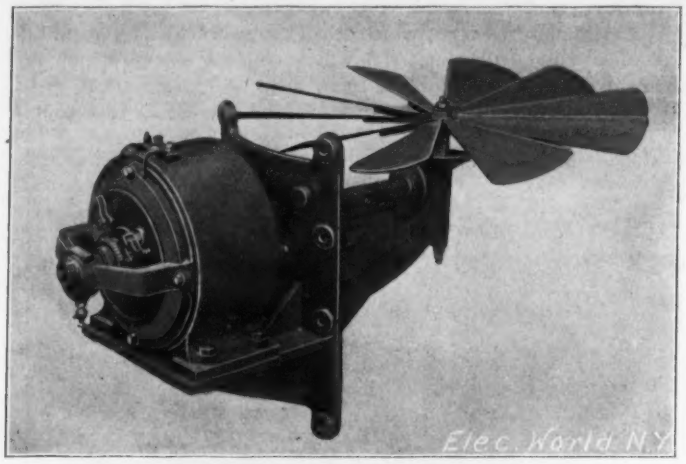


FIG. 18.—HELICOIDAL BLOWER OF SOCIETA BACINI.

and the output is 2960, which is a commercial efficiency of 85 per cent.

These motors were first used to operate ammunition hoists, but quite recently they have been used to drive ventilating fans also. The fans are of the centrifugal type, and departing from the usual

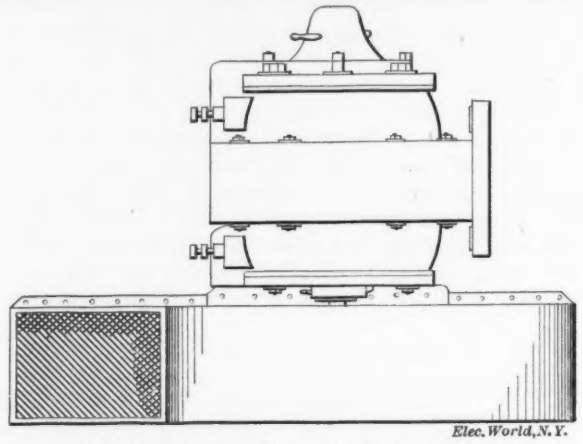


FIG. 20.—CENTRIFUGAL BLOWER AND MOTOR.

practice which supports the motor by the fan, requiring the latter to be extremely heavy, an arrangement shown in outline Fig. 20 was adopted, which admits of much lighter construction. There are, however, many types of fans in use, both of the centrifugal and screw forms.

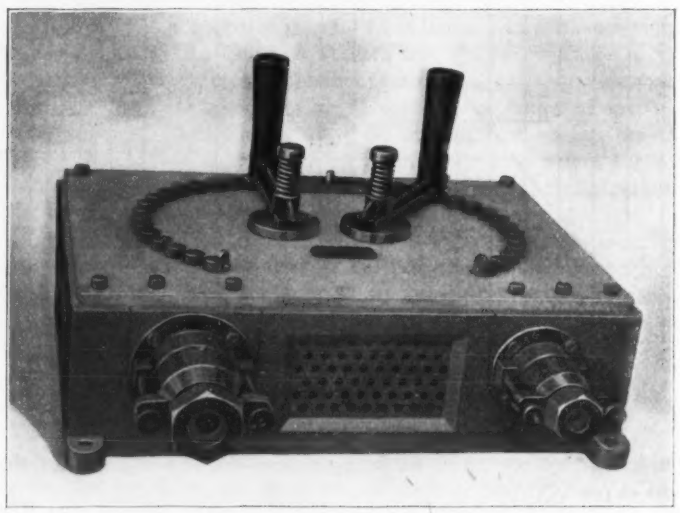


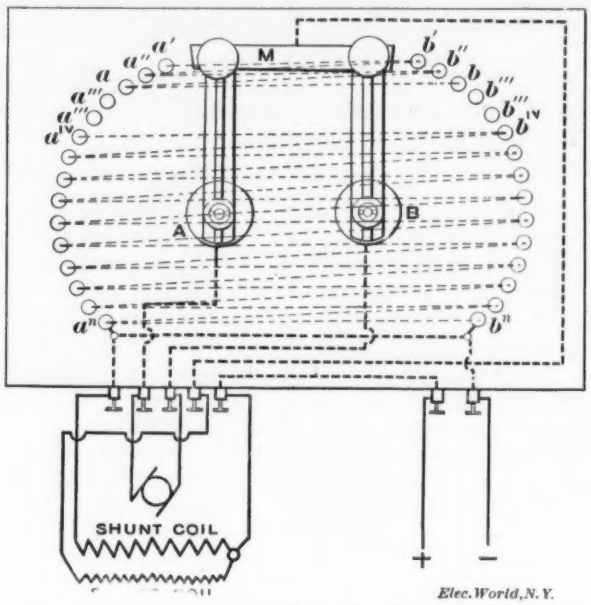
FIG. 22.—REVERSING RHEOSTAT FOR MOTORS.

Lengthy experiments have furnished data from which the best type of ventilator for any given duty is easily arrived at, and its performance under any given set of conditions may be predicted

with certainty. The C. & C. centrifugal blowers built by the Edison Company of Milan, were much used at first, and recently, those built by the Società delle Officine di Savigliano, a cut of which is given in Fig. 19. This type was considered superior to one of a similar form made by Siemens & Halske, notwithstanding that the screw type blowers made by that firm were widely used, especially the K 4 and K 3 types. These blowers are preferred for large ventilating ducts, although being inside the duct they are rather inaccessible. This difficulty has been remedied by the Bacini Company of Genoa, which puts out a form in which the motor is separated from the fan and can be outside of the walls of the duct.

Fig. 18 gives an excellent idea of this construction which has given very good results on the Argentine Cruiser Pueyrredon, built at Genoa and similar in design to the Cristobal Colon. The power is transmitted from the motor to the fan by a pair of friction cones made of celluloid; the motor is secured to a plate curved to fit the air duct in which the fan is to be operated.

Fig. 21 shows the starting rheostat used with these outfits. Other motors are provided with starting apparatus which comprises a



Elec. World, N. Y.

FIG. 23.—DIAGRAM OF CONNECTIONS FOR REVERSING RHEOSTAT.

reversing switch and an arrangement for stopping the motor either suddenly or gradually, as desired. A glance at Fig. 22 and 23 will make the operation of this apparatus clear. Two handles A and B are free to turn about their centres P and Q and make contact with two series of contact points a, a, a, a, and b, b, b, b, though normally they rest on the metal strip M. This strip and the adjacent points a^1, a^2, b^1, b^2 are connected by a resistance wire; the points a^3 and b^3 are insulated, and all the remaining ones are connected by a continuous resistance wire having a range of 1½ to 2 ohms. The outside connections shown in the diagram are for a compound motor.

When the handles are both resting on M, the armature is short circuited; so long as each moves through the same angle the armature circuit remains closed on a small resistance. With one handle in contact with M and the other on a^1, a^2, or b^1, b^2, as the case may be, the armature circuit is locally closed on a rather large resistance while the main circuit is still open. When the handle reaches the contact point a^4 or b^4, the motor starts, the direction of rotation being determined by which ever of the handles has been moved.

The last contact point cuts out all the resistance and brings the motor up to speed.

When the handle reaches a^1 a^2 again, the motor is stopped more or less rapidly, and when it reaches M it is stopped suddenly. Any accidental wrong movement of the handles stops the motor.

Batteries in Alternating Current Stations.

BY T. H. MINSHALL.
Electrical Engineer for Borough of Croydon, England.

The coal bill of an alternating current station is proverbially bad, and it seems almost an axiom that it should be worse than that of direct-current stations of similar output. This is more or less inevitable, owing chiefly to two causes, viz., the poor load factor and the low efficiency of distribution. Both of these are usually capable of considerable improvement, but the present article deals more especially with the possibilities of increasing the former.

Whatever may be the case in future, the single-phase motor of the present leaves a lot to be desired, and is undoubtedly inferior to its direct-current prototype in general utility; as a result, the day load of a small alternating station is, as a rule, trifling, consisting to a large extent of the core loss of the transformers. No doubt this state of affairs is merely temporary and a day load will eventually appear, but in the meantime the smallness of the latter must be reckoned with.

The usual practice hitherto has been to put down a small steam plant which is naturally rather wasteful of both oil and steam. It also necessitates the presence of a driver and fireman continually, and a heavy loss through radiation from the steam mains, etc. It would hardly pay to run a condenser specially for the small engine, and non-condensing would (in condensing stations) mean using up all the soft water in the hot well and filling up the latter from some outside source, which, of course, does away with one of the great advantages of condensing.

Assume a station which has an average day load of 10 to 20 kilowatts. An engine suitable for this load running most of the time less than half loaded might easily use 60 to 80 pounds of steam per kw hour, and this figure would be much increased as the load dropped; unless a special boiler of the exact size were available, the consumption of coal would be correspondingly heavy.

Taking stores, wages, etc., into account, it will easily be seen that this day load results in a very substantial loss, and as a rule it will be found a day load does not pay in an alternating station until of sufficient magnitude to load up one of the main units.

If a battery sufficient to supply the day load for say 12 hours and a dynamo capable of charging the latter in six hours be installed, a great saving may be effected, and a battery would seem to be admirably suited for dealing with a small and variable day load inasmuch as, unlike the other plant, its efficiency is not much affected by the decrease in the load, i. e., rate of discharge. The dynamo may with advantage be coupled to the day load plant and detachable couplings arranged between the engine and alternator in order that the former may be disconnected during the daytime, leaving the alternating and direct-current dynamo to work together as a motor generator.

During the peak the battery, if not fully charged, may also be used for exciting purposes, and this will be found a far more reliable and satisfactory method than the use of either combined or separate exciters, necessitating frequent inspection and care; it has also the advantage of helping to slightly reduce the quantity of steam required at the peak. If thought desirable, the battery may be used to still further reduce the peak by discharging its energy through the motor generator on to the busbars, and though as a rule the energy thus available is only a small proportion of the total load, at times of shortness of steam, etc., it is of the utmost help, in addition to occasionally obviating the necessity of running another machine or boiler for a short time when the load is a little too great for those in service.

It is also very useful for providing station lighting at times when the main plant is shut down, such as Sundays, etc. When the load has gone off the battery may be charged either directly by the engine of the day load plant or through the motor-generator set from the main alternators. When there is practically no load, public or private, after midnight, the latter method would probably be the best to use until midnight, after which the small set would be sufficient to supply the mains and charge the battery at the same time. The former course would be continued all night at any time the engine was out of service, and the battery can be cut out if desired while the motor-generator or steam exciter does the exciting.

The usefulness of the motor-generator is not confined to improving the load factor, but it can also be used to improve the power factor, which naturally tends to fall as the load on the transformers decreases. This is accentuated when rectifiers are in use, especially with iron-cored and bad regulating alternators, and may easily drop to 0.8 or lower. When, however, the battery is being charged through the motor-generator, the field of the latter can, by over-excitation, be made to produce a leading current, counteracting the lagging currents on the rectifiers and transformers, and, of course, at the same time increasing the efficiency of the main alternators.

It will easily be seen that the direct advantages of the system to

a small station are various and considerable, while the indirect advantages, such as being able to shut down steam mains for repairs and leaving the whole station (in a fogless town at least) in charge of a switchboard boy, more than compensate for the increased outlay and complication; more especially now that reliable batteries are becoming cheap.

A One-and-One-Half Watt Lamp.

By Alton D. Adams.

THE Nernst lamp is presented, with claims for smaller cost, higher voltage, less exact regulation, and about twice the efficiency of the carbon filament. Contra to these advantages is the necessity for special starting devices at each lamp. Admitting all the claims for this new illumination, it is interesting to note its probable effect on present arc and incandescent lamps, the design of electric circuits, capacity of central stations, cost of electric light and its extended use. Considering first the requirement that the filament of the new lamp must be heated by some external means before it passes sufficient current to become incandescent, it is evident this quality constitutes a great drawback for small candle powers, such as now do the great bulk of incandescent lighting.

The public, having experienced the convenience of the snap-switch and key-socket, will return with bad grace to the match and taper, and it seems hardly probable that an automatic heater will be practical with each 10 or 16 candle lamp.

When used in very large candle powers to replace arc and large incandescent lamps this new illumination is not at the same disadvantage because of the heating requirement, as personal application of heat is not then so inconvenient and can be avoided by automatic heaters.

The cost of present incandescent lamps at 20 cents each and only 500 hours' life is only 1 cent for twenty-five hours, or 120 cents for a year of 300 ten-hour days; it is therefore evident that the new lamp cannot effect any great saving in this direction. For open-arc lamps the cost of carbons may be taken at 1½ cents every ten hours, or 75 cents for each 500 hours burned; and, as the new lamp is stated to last 500 hours, it will be interesting to learn whether the new filament or rod for a lamp equal to an arc can be had for less than 75 cents. Moreover, the enclosed arc greatly reduces above low cost of carbons.

It is claimed that the Nernst lamp can be readily produced to burn at 500, or even 1000 volts, in large sizes, and that a great saving in copper for distribution will therefore be effected by it.

If this claim can be sustained it is a most important one for the new lamp; but let us see. Admitting that as small as 16-candle lamps can be produced in this new form to burn perfectly at 500 volts, who would want them? Is it at all practical to introduce at lamp sockets or terminals in the dwelling, factory or place of business a pressure of 500 volts? The carbon filament lamp for 220 volts has been in the open market for about two years, but there has been no great adoption of it thus far, and it is well known that material modifications in 110-volt fittings are necessary to render them safe and practical for 220-volt work.

Before 500-volt lamps, in reach of every one, as these small lamps must be, are put into use, an entirely new line of sockets, switches and fittings, of a much more substantial and costly nature, must be produced. With the best that could be done, it is doubtful whether the security to life and low fire risk which now attach to incandescent lighting could be maintained at 500 volts' pressure for small lamp terminals.

For large incandescent and arc lamps, which can be put out of ordinary reach and have some skill exercised in their manipulation, a high working pressure is a very valuable quality, and should give the Nernst lamp a decided advantage for large space and street lighting. If, as stated, a much greater per cent. of pressure variation is permissible with the new lamp than with the carbon filament, the cost of electric circuits may be reduced, even at the same voltage, and the service at the lamp improved.

By far the most important claim made for the new lamp is that of efficiency, this being stated at about 1½ watts per candle, or twice that practical with the carbon filament. Such a gain in efficiency would be far-reaching in effect, the capacity of central stations would be doubled, the cost of incandescent light divided by 2, and its use greatly extended.

At one-half present prices incandescent light would be cheaper than gas, and for many locations would have an advantage over the arc lamp.

Considering the high pressure, say 1000 volts, at which the Nernst lamp may be burned, it may be expected to displace the arc for street lighting, as well as interior work, to some extent.

The most unsatisfactory electric machine with which we have to do is the constant-current arc dynamo, because of its low efficiency and small practical capacity, yet there is nothing to replace it for long-distance arc lighting.

An incandescent lamp using 1½ watts per candle and capable of use on constant-pressure mains at 1000 volts, may well become a serious competitor of the long-distance arc, and this means that in time the old constant-current, high-pressure, small-capacity, arc dynamos with which many stations are filled may be replaced by a smaller number of more efficient constant-pressure generators, and this hope is one of the best that the new lamp holds out to us.

As at present presented, therefore, the Nernst lamp seems more adapted to light large interior spaces and to displace arcs at long distances than to wrest from the carbon filament its hard-earned eminence for positions that require decided light.

Motor and Dynamo Efficiency Under Varying Conditions.

By Frank G. Baum.

Numerous methods have been published for determining the efficiency, or best efficiency, of a continuous-current motor or dynamo, many of which are of great practical importance. However, motors and generators are not always operated under the conditions made in testing for the best efficiency, and consequently the current which the mechanism should take from, or give to, the mains, in order to get the best results, may be quite different from the currents that gave the best efficiency under test. A problem then, of some practical importance is the following:

A shunt motor or dynamo, the armature and field resistance being known, is to take or give current as a given potential, required the current to be taken from or given to the mains in order that the motor or dynamo may work with the best efficiency. We take the case of the motor first:

Let R = resistance of the field,
r = " " armature,
$C a$ = current in the armature,
$C f$ = " " field,
C = " " external circuit,
e = back e. m. f. of motor,
E = the e. m. f. of the mains.

We have

$$C = C a + C f. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

and

$$C a = \frac{E - e}{r}. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Practically all the losses in the motor, with the exception of the $C^2 R$ losses—which will be separately taken account of—are proportional to the speed of the motor, and, therefore, may be expressed as some constant multiplied by the back e. m. f., i. e., $e K$; K corresponds to the currents, at a potential e, necessary to overcome mechanical friction and supply hysteresis losses. The current K may be determined in the usual manner. The efficiency of the motor may now be written:

$$\epsilon = \frac{e\left[\frac{E-e}{r} - K\right]}{E\left[\frac{E-e}{r} + \frac{E}{R}\right]}. \quad \ldots\ldots\ldots\ldots\ldots (3)$$

Taking the derivative of this with respect to e and equating it to zero, gives, after using equations (1) and (2) to get everything in terms of C, E, r, R and K:

$$C^2 = \left(\frac{E}{R} + \frac{E}{r}\right)\left(\frac{E}{R} + K\right). \quad \ldots\ldots\ldots\ldots (4)$$

From this equation we can at once determine the current to be taken from the mains to give the best efficiency. We see that the current should increase somewhat faster than the square root of E.

If we use the same method for the case of a dynamo we get an exactly similar result. Equations (1), (2) and (3) become:

$$C = Ca - cf. \quad \ldots\ldots\ldots\

site segments of the commutator, using, of course, a clamp that will not make a short circuit. If coils and commutator are perfect, this will divide the current into two equal parts. Prepare an induction coil with primary of very low resistance, and connect the secondary with a good telephone receiver. Proceed to test the coils of upper half of armature with two ends of primary, keeping the receiver to the ear.

In the accompanying sketch, the coil connecting segments 1 and 12 is broken, and therefore no sound will be heard until the wires from the primary span these segments, when the sound will be very loud, locating at once an open circuit in the coil, which may be marked. Temporarily short circuit these two segments, and proceed to test other coils. Normally the hum in the telephone will be uniform, its loudness being determined by the resistance of the coils and the strength of current used. Segments 6 and 7 are short circuited, and when primary wires are connected to these, the sound will be scarcely audible, as almost all current passes through the short circuit. Thus the method described may be used for both tests at one time.

When an alternating current is not available, I have used a number of primary cells in multiple, with a good interrupter in the circuit, and have obtained excellent results. The theory of the test is so simple as not to need any comment.

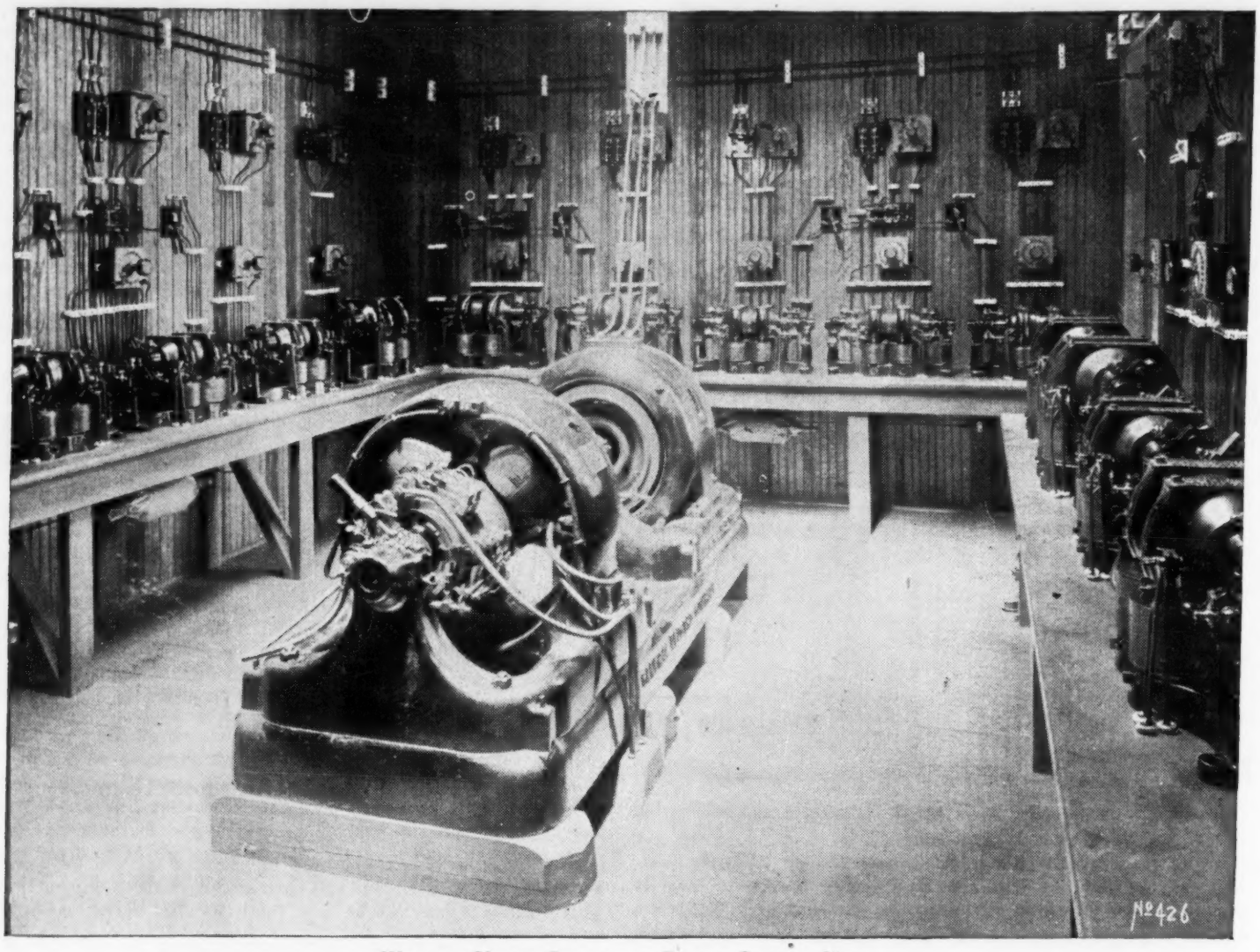
Wireless Telegraphy Across the English Channel.

A despatch from London on March 28 states that cross-channel tests of Marconi's system of wireless telegraphy were commenced on the day previous. The French station is at Wimereux, near Boulogne, and the English station is at the South Foreland Lighthouse, the distance between the two being 32 miles. Thus far, it is stated, the experiments have been entirely successful, the messages passing with the greatest ease. Signor Marconi is personally superintending the tests.

Generating Plant of the Western Union Telegraph Company at Omaha, Neb.

The substitution of primary battery plants in telegraph offices by dynamo systems goes on apace in this country, and the work has now assumed strikingly large proportions. One of the latest installations of such a character is that of the Western Union Telegraph Company at Omaha, and through the courtesy of the Sunday *World-Herald* of that city, we are enabled to show the dynamo or generating room, the apparatus in which has now for some few months been doing all the work formerly done by 11,000 cells of battery, with all their attendant disadvantages on the score of space occupied, care needed, cost and uncertainty.

The system is novel in the fact that the first source of current is the three-phase system of the New Omaha Thomson-Houston Electric Light Company. A 15-hp 200-volt 3-phase motor is, as seen in the engraving, placed in the centre of the room and is direct connected to a 9-kw direct current 125-volt generator. Very satisfactory results are obtained from the combination. The generator in turn furnishes current to operate the following assortment of Crocker-Wheeler motor-dynamos: two ½-hp with 7-volt secondaries; two 1-hp with 24-volt secondaries; three ½-hp with 85-volt secondaries; three 1-hp with 170-volt secondaries; three ½-hp with 255-volt secondaries; three 1-hp with 340 volt secondaries. All the motor dynamos have their primary portions wound for 110 volts. We are indebted for this data to Mr. J. J. Dickey, the District Superintendent, whose headquarters are at Omaha, and to Mr. A. S. Brown, electrical engineer-in-chief of the Western Union Company. The new operating room and general service at Omaha is in keeping with the other parts of this progressive plant and is in charge of Mr. W. W. Umsted, the W. U. manager, at Omaha. The growth of telegraphy in the region named has thrown a large amount of new business upon the Omaha office, but the resources of the system as indicated above have easily met all demands.



Western Union Generating Plant Omaha, Neb.

Telephony in the Smaller New York Cities.

DURING the recent hearings on the telephone rate bills before the New York State Senate Committee on Miscellaneous Corporations, at Albany, Mr. H. E. Hawley, General Manager of the Hudson River Telephone Company, made an argument in opposition to the Marshall bill, in which he brought out some interesting facts as to the existing telephonic conditions in the smaller towns and cities throughout the State. The Hudson River Telephone Company operates over 50 exchanges in seventeen counties in New York State, and has about 10,000 subscribers. In spite of this large and scattered clientele and in spite of the company's principal exchange being at Albany, no subscriber of the company appeared in support of the bill. A very sufficient reason for this absence of support from the people that the bill was supposed to benefit was, Mr. Hawley claimed, that most of the Hudson River Company's subscribers would have their rates increased if the rates named in the bill were fixed by law. In other words, the service would be put beyond the reach of a large number of people who at present, thanks to the system of message rates adopted by the Hudson River Company, find it within their means.

In the territory of the Hudson River Company there are four exchanges, which, according to the census of 1890, have a population between 20,000 and 100,000—Albany, Kingston, Newburg and Poughkeepsie. The bill fixes a rate of $36 for these exchanges. The rates in Albany, which now has a population of over 100,000 and over 2500 telephone subscribers, range from $30 upward. That the present rates are considered reasonable and satisfactory by the Albany public is shown, he said, by the increase of subscribers: In 1895 there were less than 1400, while at present there are over 2500, the system having nearly doubled in the past four years. A very objectionable feature of the bill, which, by the way, has now been defeated, was that it made the small places bear the burden of the larger cities. The bill fixes rates according to the population shown by the census of 1890, and fixed higher rates for the larger exchanges and lower rates for the smaller exchanges. But there was no step between 20,000 and 100,000 population. Consequently, a situation developed like this: Kingston, with a population of 21,000 and 400 subscribers; Newburg, with a population of 23,000 and 360 subscribers, and Poughkeepsie, with a population of 22,000 and 380 subscribers, would all be saddled with the same rate as Albany, with its population of 100,000 and its large system of 2500 subscribers. The bill itself recognized that rates should vary with the size of the exchange, but was so crudely drawn and with so little regard for the interests of the various communities to which it related that it would tax on the small places a large part of the cost of furnishing telephone service in the larger cities. On the other hand, that a large city like Albany, whose telephone system is equipped with an underground cable plant, multiple switchboards and other expensive apparatus necessary to successfully operate so large an exchange, should have service at the same flat rate as charged in much smaller towns like Newburg, Poughkeepsie and Kingston, would be manifestly unfair.

Mr. Hawley proceeded to point out that the bill had been drawn by persons interested only in New York City, but it fixed rates for hundreds of smaller places throughout the State without any regard to the existing conditions in those places, and it was evident that those who drafted the bill had no information as to the rates actually in force in many of the places that would be affected by the bill. In numerous cases the rates were all lower than those named in the bill and in other places the majority of subscribers paid lower rates than those the bill would impose. The Hudson River Company had some years ago introduced message rates, and the message rate system had led to a much larger and more general use of the telephone service. By means of the message rate system the advantages of the telephone service had been placed within the reach of a much larger number of people than would ever have been possible with flat rates, and this development would be promptly checked by the passage of the bill.

As an instance of the actual conditions of the telephone business in various cities of the State, conditions entirely ignored by the Marshall bill, Mr. Hawley cited the case of Schenectady. This city in 1890 had a population of 19,902, which would make the rate $30 a year. If there had been 99 more people enrolled on the census, the rate for Schenectady would have been $36 a year, and this would have made a difference in the annual revenue of over $2000. At the present time Schenectady has a population exceeding that of Newburg, Poughkeepsie or Kingston, and yet in this bill the charge is fixed at $36 a year for those towns twenty per cent. more than for Schenectady, although Schenectady has the larger population; but the bill says the rate shall not be advanced for increase of population over that based on the census of 1890. The growth in this city during the past nine years has been entirely ignored, and if Schenectady should grow to have a population of over 100,000, as it easily may, being a centre of electrical industry, still the telephone rate under this bill would be kept at $30 a year.

Another peculiarity is illustrated in the condition in the City of Rensselaer. Under the bill the rate in this place is $27 a year. Service in Rensselaer is now furnished in connection with the Albany exchange. The citizens in Rensselaer pay the same rates as the citizens of Albany and no extra charge is made against a Rensselaer subscriber for communicating with a subscriber connected with the Albany exchange. If this bill were passed Rensselaer subscribers would pay $27 a year, and in addition would be compelled to pay a toll for each communication with an Albany subscriber. The combined charges for rentals and tolls would be far more than the Rensselaer subscribers now pay, thus working a particular hardship upon that community.

Another instance showing how such legislation ignored existing conditions is found in the case of the cities of Johnstown and Gloversville. In 1890 Johnstown had a population of 6668 and Gloversville 13,864. These cities, being near together, and their business interests so closely connected, are operated as one exchange. The rates vary from $24 a year upwards. Under this proposed bill Johnstown's rate would have been $27 a year and Gloversville's rate would be $30 a year, with a toll charge for each communication between the two places. Under these conditions the telephone expenses of the average man in Johnstown and Gloversville would be far more than doubled. Similar conditions exist at Glens Falls, Sandy Hill and Fort Edward. A most astounding fact was that only 10 per cent. of the people would have had their rentals reduced, whereas 90 per cent. would be increased, and they would further be required to pay tolls for communications between the several towns. Under the rates proposed in the bill, and taking the tolls into consideration, they would have had to pay far more than double the rates now paid.

In places with a population of less than 8000 the rate fixed in the bill was $27 a year. The Hudson River Company has 36 exchanges of this size where the rates range from $18 a year upward, and because of the low rates at which the company is now furnishing an excellent service the use of the telephone is becoming very widely extended and all classes of people are enabled to have it in conducting their social and business affairs.

Nineteenth Annual Report of the American Bell Telephone Company.

At Boston, on March 28, President John E. Hudson presented to the stockholders of the American Bell Telephone Company the nineteenth annual report, and below is presented a digest of its impressive figures, which show the largest business ever done by the Company in a single year.

It appears that the Company now has in the hands of licensees under rental 1,124,846 instruments, or a gain of 205,725 during the year, while the gain in 1897 was 60,000 less. On Jan. 1, 1899, there were 1126 exchanges, 1008 branch offices, 396,503 miles of wire on poles, 15,329 miles of wire on buildings, 358,184 miles of underground wire, 2973 miles of submarine wire, and a wire total of 772,989 miles. There was a total of 338,293 circuits, 19,668 employees, and 465,180 telephone stations. The estimated number of exchange connections daily in the United States, by test count, was 3,823,070, or a total for the year of about 1,231,000,000. The daily calls per station varied from 1 3-10 to 18 7-10, with an average of 8 2-10. The cost to the subscriber varied, under differing conditions, from less than 1 cent up to 9 4-10 cents per connection. There were 75,718 miles of extra territorial and pole lines with 385,911 miles of wire, and a total of 30,600,000 toll connections for the year, yielding a revenue of $5,571,710; but this did not include the "long distance" earnings of the American Telephone & Telegraph Company, which had on Jan. 1 a little over 10,000 miles of pole line and cable and 123,275 miles of wire connecting 285 offices.

The new construction reported by the Bell sub-companies,

amounted to $12,105,921. Of the 38 companies now furnishing the long line terminals, their 409,250 stations were to the extent of 48.96 per cent. metallic circuit, and of these 200,528 stations, 25,158 are equipped with long distance cabinet sets. The entire expenditure by the sub-companies to the close of 1898 reached the large sum of $111,159,309.

The report makes reference to the success of the measured rate service, and states that out of the 465,000 subscribers in the United States, 90,143 are now getting that class of telephony. Making a comparison, President Hudson says: "The statistics of European countries at the close of 1897, taken from such reports and publications as can be obtained, showed the number of exchange stations in the German Empire to be 173,981; in Sweden, 56,500; in Austria and Hungary, 33,862; in Switzerland, 32,252; in Norway, 20,678; in Russia, 20,108; in France, estimated, 45,000; in all of Continental Europe together, 453,844; in Great Britain and Ireland, at the end of 1898, 103,084. At that time the American Bell Telephone system in the United States numbered 465,180 exchange stations. Toll line conversations in this country are held over distances of about two thousand miles; the longest telephone line in Europe being 850 miles."

Below is given the comparative statement of earnings and expenses.

EARNINGS.

	1897.	1898.
Rental of Instruments	$1,597,959.36	$1,610,855.64
Dividends	3,085,379.00	3,239,406.58
Commission from Ex-Terr. Lines.	211,507.21	121,511.07
Commission from Teleg. Business.	33,174.32	18,389.20
Real Estate	84,709.85	83,864.92
Interest	117,071.93	370,991.58
Miscellaneous	1,043.25	3,682.50
	$5,130,844.92	$5,448,701.49

EXPENSES.

Expenses of Operation	$509,314.02	$509,673.90
Legal Expenses	136,333.49	94,226.62
Real Estate	41,560.76	40,235.09
Interest and Taxes	273,961.92	408,851.65
Miscellaneous	.....	1,747.42
	$961,170.19	$1,054,734.68
Net Earnings	$4,169,674.73	$4,393,966.81
Surplus Account, Dec. 31, 1897	$2,590,521.27	
Net Earnings, 1898	4,393,966.81	
		$6,984,488.08
Regular Dividends, 1898	$3,106,356.00	
Extra Dividends, 1898	776,589.00	
Reserve for Depreciation of Insts.	316,469.24	
		4,199,414.24
Surplus Account, Dec. 31, 1898		$2,785,073.84

The ledger balances show: Debtors—Telephones, $2,248,532; real estate, $1,052,695; stocks and bonds, $58,776,425; merchandise and machinery, $18,270; bills and accounts receivable, $2,086,092; cash and deposits, $676,987. Creditors—Capital stock, $25,886,300; premiums on same $6,110,582; debenture bonds, 1888, $49,000; debenture bonds, 1908, $5,000,000; bills and accounts payable, $1,277,827; patent account, profit and loss, $12,399,147; profit and loss, $6,851,515; reserve, $4,499,558; surplus, $2,785,073. Of the bills payable, $1,164,883 is for dividends due Jan. 16. The total of each side is $64,859,004. All the books and reports are duly audited.

CURRENT NEWS AND NOTES.

KILLING GREENHOUSE PESTS.—According to a recent article in the London medical journal, *Lancet*, ozone is of considerable service for horticultural purposes, as many of the greenhouse pests, if not all of them, can be destroyed by it.

UTILIZING WAVE POWER.—It is alleged that a contract has been signed for a $100,000 plant to furnish 1000-hp to be developed from the waves of the ocean, the first of the kind ever made. This power is for a sanitarium to be built at Sea Gate, adjoining Coney Island. The power is to be converted into electricity which will be all the work, lighting, heating, etc. Experiments have been going on for a long tim eat Galilee, N. J., where a station for the purpose was built, and which, it is claimed, has demonstrated the success of the idea and its practical use. This device takes no account of the rise and fall of tides, but it makes use of the wave motion.

BROOKLYN ELEVATED RAILROAD RECEIVER DISCHARGED.—Mr. Frederick Uhlmann, receiver of the Brooklyn Elevated Railroad Company, was, on March 25, discharged by Justice Maddox in the Supreme Court, Brooklyn. After the court proceedings Mr. Uhlmann turned the property over to the Brooklyn Union Company, which is the name of the reorganized corporation. The following named gentlemen were promptly elected directors of the Brooklyn Union Company: Fred R. Olcott, Clinton L. Rossiter, T. S. Williams, William Hollis, Jr., Frederick Uhlmann, William F. Sheehan, Nicholas F. Brady, Fred S. Flower, John S. George, Ira S. Kipp, John B. Taylor, John V. Clarke and Henry Folger. The directors elected Mr. Rossiter, president, and Mr. Williams, secretary and treasurer. From the names of the directors and officers, it is evident that the elevated road has formally passed under the control of the Brooklyn Rapid Transit Company.

EVOLUTION OF AUTOMOBILISM.—Discussing the history of automobile development in the New York *Press*, Col. A. A. Pope says: "The earlier attempts to produce motor vehicles were failures, as heretofore explained. They were unwieldy and clumsy and too costly to maintain. The introduction of railroads in the first half of the century practically put an end to their use. Since the early eighties the improvements in gasoline motors have enabled inventors to create more or less satisfactory horseless vehicles. The development of these has suffered to a certain extent because of a degree of complication in construction and operation, puzzling to the average purchaser, but simple enough to the inventor, maker and expert mechanics generally. That is a result of sacrificing simplicity for the unnecessary requirements of great speed and purely technical considerations. Hence comes the advantage of electricity for the power in horseless vehicles. Of all mechanical devices those involved in the application of electricity are most familiar to the general public. It is by the use of that power that it has been possible for the Americans to produce their modern vehicle, the manipulation of which requires no greater mechanical knowledge than the pressing of an electric button and no greater watchfulness than in driving a horse. That the American electric carriages are a success is evidenced by the fact that they are sought by purchasers in the well provided markets of Europe in even larger numbers than in the home country."

NEW YORK UNDERGROUND.—The Rapid Transit Commission has received an offer from parties understood to represent the Metropolitan Street Railway Company. The capitalists who offer to build, maintain and operate the underground rapid transit system propose to form a new corporation, to be known as the Tunnel Company. According to the plans as presented the underground road is to be a part of the electric general system of the Metropolitan with stations at various given points for the switching of cars from the underground tracks to the surface, or vice versa, or for the transfer of passengers. Transfers from one system to the other are to be issued upon the payment of 3 cents in addition to the original fare of 5 cents. Express trains are to be run at a prescribed rate of speed and in accordance with given schedules, upon which the fare shall be 10 cents. Transfers from these trains are to be issued free. The underground system, according to the proposal, is to be leased to the Metropolitan Street Railway Company in perpetuity, or for a term of years practically equivalent thereto. In return, the projectors of the enterprise propose that the city shall receive as a financial compensation "an annual rental equal to 5 per cent. on the gross receipts from the operation of the new road; provided that whenever any such payment shall leave the receipts insufficient to pay the rental of 5 per cent. on the cost of construction and the operating expenses, including taxes, the percentage to be paid shall be abated accordingly." The prompt construction of the system, after the granting of rights applied for, is also provided for in the proposal. The first section is to be begun within three months, and to be completed within thirty-six months, while the second section is to be begun as soon as the net earnings of the first section pay 5 per cent. on its cost, and to be completed within the next twenty-four months.

A VETO ON JUNKETS.—The Supreme Court of Michigan has affirmed the judgment of the Superior Court at Detroit enjoining the city from using public funds to pay bills incurred in entertaining the League of American Municipalities.

AUTUMN MOBILES.—First Coachman—"Did yez get the job?" Second Coachman (unemployed)—"I did not. Sez he, 'Kin yez run an autumn mobile?' 'I kin not,' sez I; 'I've druv horses twinty-six years,' sez I; 'an' whin the horses quit the business, I'll quit, too,' sez I."—Puck.

SENATOR GALLINGER, of New Hampshire, says the greatest achievement of the past century has been the marvelous advances in the knowledge and uses of electricity. The twentieth century may bring forth safe and successful ærial navigation, telephoning and telegraphing without wires, and possibly transportation for long distances of freight and passengers by the pneumatic tube process, modified and improved.

THE DREAM OF TELEPHONISTS.—In discussing submarine telephony with a New York *Herald* reporter last week, Mr. J. J. Carty, the well-known electrical engineer, remarked: "The ocean telephone cable is the dream of telephonists. We all hope to live to see its accomplishment. My belief is that such a cable will be constructed some day, but I do not think that we have yet enough knowledge to accomplish this much desired result."

AUSTRALIAN TELEGRAPHY.—Mr. Timothy Howard, of Australia, who will have charge of the government telegraph and telephone system of that country, is in the United States making an investigation of American methods. He is in consultation with the Postmaster General and other officials. Mr. Howard will report to his government the result of his investigations, which deal with the establishment, management, bookkeeping and other phases of the telephone and telegraph business.

GUNNING FOR LINEMEN.—Peter Van Buskirk, of River Edge, N. J., with a loaded gun prevented linemen from planting poles on his farm last week. The linemen were in the employ of the Hackensack Gas and Electric Company, and were building the line through River Edge in order to reach Oradell, where the company intended to supply the residence of former Mayor Hugh J. Grant, of New York, with electricity. He says the company should compensate him for permitting it to use his land.

SCARCITY OF HORSES IN CINCINNATI.—The supply of horses is not now equal to the demand in the markets here. Prices within the past six months have advanced from $5 to $20 a head. When the street railway company threw its horses on the market on the introduction of electricity, it was flooded. Prices were down, and the farmers refused to breed horses. Now all are gone, the dealers have fewer horses to sell, and the prices continue to go continually higher. Cincinnati was one of the very first cities where discarded street car horses were sold to make room for the trolley.

HELPED BY A TELEGRAPH OPERATOR.—Jim Wardner had no more money. However, he managed to reach Vancouver, and, walking into the headquarters offices of the Canadian Pacific, said to the manager in charge: "I am Jim Wardner, and I am an old friend of Tom Shaughnessy, the general superintendent. Will you wire him, and tell him that I am here, broke, and want transportation to Montreal?" Back came the reply: "Don't let Jim walk." He got the transportation, and, arriving in Montreal, called at once to thank his friend. "Well, well, Jim, is this really you?" Then, with a twinkle of the eye: "How under the heavens did you get here so soon if you were broke?" "Why, thanks to your telegram, 'Don't let Jim walk,' of course I was at once furnished transportation; and here I am!" "Confound those operators! It is strange they cannot get my messages through correctly!" "Didn't you telegraph, 'Don't let Jim walk'?" interrupted Wardner. "Certainly not. My answer was: 'Don't! Let Jim walk!'"—*San Francisco Wave.*

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material are from the port of New York for the week ending March 21: Antwerp—55 cases electrical material, $4,279; 28 packages electrical machinery, $2,560. Amsterdam—9 packages electrical material, $3,263. British Australia—146 packages electrical material, $12,068; 46 packages electrical machinery, $1,473; 688 packages carriage material, $8,966. British possessions in Africa—112 packages electrical material, $10,793. Brazil—22 cases electrical material, $1,195. Bremen—1 case electrical machinery, 115; 22 cases electrical material, $3,194. Barcelona—2 cases electrical material, $50. Cuba—104 cases electrical material, $2,359. Genoa—1 case electrical material, $50. Glasgow—14 cases electrical material, $110. Havre—77 packages electrical material, $2,161; 90 packages electrical material, $5,889. Liverpool—162 packages electrical material $8,827; 20 packages electrical machinery, $266. London—574 cases electrical material, $11,316. Leghorn—2 cases electrical material, $50. Mexico—106 cases electrical material, $1,270. Marseilles—9 cases electrical material, $854. Newfoundland—7 cases electrical material, $60. Puerto Rico—108 packages electrical material, $145. Preston—12 packages electrical material, $1,159. Rotterdam—2 packages electrical machinery, $60. Rome—6 cases electrical material, $374. Santo Domingo—23 packages electrical material, $198. U. S. of Colombia—1 case electrical material, $227.

BROOKLYN RAPID TRANSIT ABSORBS BROOKLYN ELEVATED RAILROAD SYSTEM.—The announcement is made that the negotiations which have been pending for several months past betwe n the Brooklyn Rapid Trarsit Company and the Brooklyn Union Elevated Railroad have been brought to a conclusion, whereby the Rapid Transit Company comes into possession of the Brooklyn Elevated roads. Mr. William Halls, Jr., vice-president of the Brooklyn Union Elevated Railroad Company, announces the consolidation, but would not make public the terms of the transaction. He stated that radical improvements will soon be made in the interests of the traveling public of Brooklyn Borough. The securities involved in the transaction are already in process of delivery. Mr. Halls stated that under the new arrangement passengers on the surface cars in Brooklyn now controlled by the Brooklyn Rapid Transit Company will be transferred to the Brooklyn elevated trains without extra charge. The elevated road will be equipped with electricity and there will be a general improvement in the service. The Brooklyn Rapid Transit Company now controls all the surface roads in Brooklyn with the exception of the Coney Island and Brooklyn road. The Kings County Elevated road, Mr. Halls predicted, would ultimately become a part of the Rapid Transit system. The stockholders of the Brooklyn Elevated road will receive in part payment of their shares stock of the Rapid Transit Company, which will be taken from the recent issue of $25,000,000. Of this issue $9,000,000 has already been paid for the purchase of the Nassau system, formerly controlled by Tom L. Johnson. H. B. Hollins & Co. will handle the transfer of securities, and most of the stock of the Brooklyn Elevated Company was last week turned over to that firm.

STORAGE BATTERY PATENTS.—Among the patents of March 21, are two on improvements in storage batteries, and a third on a storage battery transfer switch. One of these, issued to P. J. Dujardin, of Paris, relates to storage batteries of the lead-zinc type. In this type of battery the presence of mercury is stated to be indispensable, in order to avoid local action when the circuit is open, and to permit of amalgamation of the layers of zinc added during charge. Several forms of plates are described, but all consist of vertical supports for horizontal conductors of small thickness and suitably spaced vertically. These horizontal portions of the plate may be either of zinc of carbon coated with zinc. One form consists of a number of small zinc wires twisted in the form of a cable, the interstices of which retain by capillary attraction a quantity of mercury sufficient to keep the zinc amalgamated. Other forms of plates are described, in which other means are used for retaining the mercury. A patent granted to A. Schanschieeff and A. E. Hodgson, of Halifax, England, is for a form of plate having strength and rigidity with comparative lightness, and also providing sufficient locking facilities for holding the paste. One of the forms of plate described, consists of two perforated lead plates superimposed. In making the perforations the metal at the edges of the holes is caused to project, and when the two plates thus punched are placed with their flat surfaces together and the holes coinciding, the protruding edge of the holes serve to hold the paste between the plates. A patent issued to Charles Hewitt, of Philadelphia, relates to a transfer wattmeter switch for storage-battery circuits, the object of which is to provide apparatus for measuring current intermittently supplied to and from a storage battery. A mercury switch is used in connection with two wattmeters and with an electromagnet arrangement such that when the battery is being charged, the current is switched through one meter and on discharge is switched through a second meter.

A SCHOOL OF ELECTRICITY AT THE BROOKLYN NAVY YARD.—Lieut.-Commander L. C. Heiller has been ordered to organize a school for the instruction of naval apprentices in the study of electricity at the navy yard in Brooklyn.

MR. JOHN SHERMAN, who has been touring through the West Indies on the "Paris" with about 400 other Americans, was reported dead, much to the consternation and grief of everybody. Captain Leigh, Chief Signal Officer at Santiago de Cuba, states that an official of the French Cable Company was to blame for the false report.

COHERERS.—Prof. Lodge in a recent lecture drew an analogy between the coherer and the microphone, stating that the former was affected by electric waves in very much the same way as the latter is affected by sound waves. He was surprised that so much interest was taken in wireless telegraphy, as that was the only kind of telegraphy used 100 years ago.

YERKES ELECTRIC FOUNTAIN INJURED.—The Yerkes electric fountain in Lincoln Park, Chicago, has been despoiled of nearly all its brasswork. Some time during the past week thieves have been operating on the fountain, and have carried away over $1200 worth of brass. In taking away the brass fittings of the fountain they did a great deal more damage than is represented by the value of the brass itself.

ELECTRICITY IN TOWN AND COUNTRY HOUSES, by Percy E. Scrutton, is the title of a popular, practical and fully illustrated handbook to be issued immediately by the Macmillan Company. Domestic applications of electricity have been treated in this volume in as concise and complete a manner as possible, so that it may come within the compass of the every-day well-informed householder as well as the electrician.

JAPANESE APPRECIATION.—While in Japan, Prof. Crocker had the pleasure of learning that the book by himself and Dr. Wheeler on the care and management of dynamos and motors had been translated in the language of the empire and was being issued in parts. All the cuts had been redrawn in the Japanese fashion. Whether the authors of that valuable little manual are deriving any royalty from the translation is not stated.

WIREMEN TO QUALIFY.—A bill has been introduced in the New York Legislature providing that on and after July 1, next, no person shall engage in the work of electrical wiring as a journeyman, wireman, or foreman within the cities of the state unless he is duly registered in books to be kept in the offices of city clerks. The bill creates a Board of Electrical Commissioners for each city, to consist of a special wireman, a member of the Association of Fire Underwriters of the city, and one person known to possess the necessary theoretical knowledge of electrical engineering The boards are to be appointed by the Mayors of the cities. The applicants to be examined, must pay a fee of $2 for a certificate permitting them to engage in business.

THE PARIS EXPOSITION OF 1900.—Captain A. H. Mattox, of the American Commission to the Paris Exposition, states that the demand for space from the United States for the department of electricity far exceeds that which Commissioner-General Peck will be able to give. Mr. Charles Coolidge, the American architect to the United States Commission, has sailed for Paris with plans for the United States buildings to be erected at the exposition, and will at once let contracts and commence work. Mr. F. E. Drake, director of machinery and electricity to the United States Commission, has also sailed for Paris to commence work at the exposition grounds for his department. American electrical companies will furnish a good deal of the light and power throughout the exposition from plants especially constructed for that purpose.

GRAY CASTINGS COMBINATION.—A special despatch from Cleveland, O., says: A deal to form a combine of light, gray iron casting manufacturers is being projected in Cleveland. It is proposed to join all the local manufacturers into one company, which will later take in all the leading plants in the country. It is stated that the deal will eventually result in the concentration of over $35,000,000 of capital. Several meetings of the local manufacturers have been held during the past week, and it is stated that within a week or two the combine of the local firms will be effected. The local firms which it is expected will be included in the combine are the Tailor & Boggis Foundry Co., Palmer & De Mooy Foundry Co., Forest City Foundry & Manufacturing Co., Gartland Foundry Co., Standard Foundry & Manufacturing Co., and Ohio Foundry Co.

A TELEGRAPH LINE IN EASTERN AFRICA.—It is announced that an agreement has been made between the German government and the Trans-African Telegraph Company in regard to the construction of a telegraph line in the German East African protectorate as a connection with the existing South African line, in which the German supremacy of interests will be safeguarded. The Trans-African Company by this arrangement receives permission to construct the line at its own cost, the work to be completed within five years. The officers and workmen are to be subject to German laws while in the East African protectorate. The company undertakes, in addition, to build a separate line of two wires between two stations in Rhodesia nearest to the frontier and British East Africa, which shall be the property of the German government and kept up at the government's expense.

A GOLD MEDAL FOR PROF. DEWAR.—The Smithsonian Institution at Washington has conferred the Hodgkins medal upon Prof. James Dewar, of London, in recognition of his discovery of the process by which air may be liquefied. This is the first gold medal ever awarded by this institution. Thomas George Hodgkins left $200,000 to the Smithsonian Institution, one-half of which was to be spent to aid and reward discoveries of new elements or properties in air. The first call upon this fund was made about two years ago, when $10,000 was divided between the principal discoverers of the new element argon, and four silver and eight bronze medals were conferred upon those whose efforts aided in the discovery. The medal for Prof. Dewar, which was transmitted through the State Department to the United States Embassy in London, is about three inches in diameter and was cast in the mint of Paris. The bullion value of the medal is about $300.

A METHOD OF MOTOR SPEED CONTROL.—It is well known that the only economical way of varying the speed of a direct-current motor on a constant-potential circuit is by varying the intensity of the field magnetism and consequently the counter electromotive force per unit of velocity. This necessitates a field sufficiently strong at maximum speed and minimum field strength, to overcome the armature distortion under full load, and proportionately stronger at all lower speeds. This requires, in comparison with a motor regulated by armature resistance, either a wide air gap and a much heavier and more costly field structure in order to obtain the necessary magnetic intensity when way below saturation, or (what amounts to the same thing) the reduction of the rating of a given motor to a smaller number of horse power in order to cut down the armature distortion. Either course greatly increases the cost of a motor to carry a given load. The main thing that is needed in such motors is not high intensity through the main body of the pole, but only at the pole tips, where a constant flux is needed to give proper commutation. If the magnetism at the tips could be made to remain strong while that over the rest of the pole face varied, the speed variation could be obtained without increasing the air gap or limiting the amperes taken by the armature. An ingenious means of accomplishing this is described in a recent patent issued to F. A. Johnson. In one form of this invention each pole is divided, a central core being wound with an auxiliary exciting coil. Part of the field flux passes through these auxiliary coils and part passes around them by what might be called magnetic bridges leading directly to the pole tips. If an exciting current is sent through these auxiliary coils in such a way as to reverse the magnetization set up by the main field exciting coils, it will crowd the lines of force into the magnetic bridges leading to the pole tips, so that while the aggregate strength of the field is weakened and the speed of the machine thereby increased, the pole tips retain their full saturation and the commutating field remains unchanged. Several other arrangements for accomplishing the same result are described in the patent. Thus, the auxiliary coils may be wound on the branches leading to the pole tips, instead of on the main cores of the field; or, in case the motor always runs in one direction, thereby locating the commutation under only two of the pole tips, the iron leading to these alone may be wound with auxiliary coils. The same result may be secured mechanically instead of electrically by making the central portion of the poles movable and thereby varying its reluctance.

MR. W. F. C. HASSON has closed his engineering office in San Francisco, and sailed March 22 for Honolulu. Some important projects demand Mr. Hasson's attention in Hawaii, where he will remain indefinitely.

TELEPHONY IN MANILA.—The telephone franchise in Manila is said to be in danger of forfeiture, owing to defects in the service. The wires are strung on the housetops and are said to give unsatisfactory transmission.

DR. F. S. KOLLE a few weeks ago described processes of printing by the Rœntgen ray in the columns of the ELECTRICAL ENGINEER. On Sunday last the New York *Herald* produced a sample of his work in its columns with a popular account of his methods.

IF THE "GIANTS" HAD IT.—"That 16-foot electric fan, to ventilate the Hoosac Tunnel, must be a powerful wind forcer," remarked Mr. Pitt. "Yes, indeed," replied Mr. Penn, enthusiastically. "What an elegant baseball fan it would make!"—*Pittsburg Chronicle Telegraph.*

ONE SOLUTION OF THE DAY LOAD PROBLEM.—The Albany Electric Lighting and Illuminating Company, Albany, N. Y., has decided to make a day load for its plant by erecting upon some of its unoccupied property near the old gas works a building to be used for manufacturing purposes, and to supply it with light, heat and power. As at present run the company's plant has little work during the day, and it is to utilize this available power in the daytime that the company is planning the erection of this building.

DETROIT TO OWN STREET LINES.—The Michigan Legislature has passed a bill providing for the municipal ownership of street railways in the city of Detroit. Gov. Pingree has long advocated this system, and recently entered into an agreement with ex-Congressman Tom L. Johnson, who owns a controlling interest in the Detroit street railway system. The result was the passing of this bill, which provides for the appointment of three commissioners by the Detroit Common Council to arrange the terms of purchase, which are simply to be ratified by the Common Council before the agreement is closed.

ELECTROCUTION OF WOMEN.—Governor Roosevelt's refusal to intervene in the case of Mrs. Place, who was executed last week by electricity, appears to be generally approved. The "London Speaker" also says: "The execution excited an indignant clamor, but why anybody should sympathize with the woman it is difficult to imagine. Men and women who rave because a murderess has an electric wire attached to her bare leg cannot see that it is criminal to build a hotel which, when a curtain ignites, burns like tissue paper. We should be glad if Governor Roosevelt and a few resolute, hard-headed men of the same type forced the municipal administration of New York to close hotels which cannot stand a reasonable test of security. Then the reformers might await the ruin of their political careers with equanimity."

LIBEL FOR CUTTING A CABLE.—The Commercial Cable Company, through its attorneys, George D. Watrous, of New Haven, and William W. Cook, of New York, filed a libel in Admiralty in the United States District Court at New Haven, Conn., on March 20, and under it the United States Marshal has seized the schooner William H. Bailey in New Haven. The ground of action is the alleged cutting of the submarine cable of the Commercial Cable Company running from New York to Europe by way of Canso, Canada. It appears from the libel that the anchor of the schooner fouled the cable in New York Harbor, and that instead of disengaging the anchor of the schooner cut the cable, in violation of the treaty of March 14, 1884, between the United States, Great Britain, France and other nations, relative to the protection of cables, and in violation of the act of Congress making it a criminal and civil offense to cut such a cable except to save the life and limb of the master or crew, or to save the vessel.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The one hundred and thirty-third meeting of the Institute was held at 12 West Thirty-first Street, New York City, Wednesday evening, March 22, President Kennelly in the chair. A paper was presented by Dr. M. I. Pupin, of Columbia University, on "Propagation of Long Electrical Waves." The paper was discussed by Messrs. Bradley, Carty, Kennelly and Steinmetz. At the meeting of council in the afternoon the following associate members were elected: Tom Howard Gregg, superintendent electrical construction, U. S. Lighthouse Board, Tompkinsville, S. I., N. Y.; residence, New Brighton, S. I. Harold J. Horn, electrical engineer, John A. Roebling's Sons' Co.; residence, 36 West State Street, Trenton, N. J. Howard S. Johnson, engineer and sales agent, Morgan-Gardner Electric Co.; residence, 70 Jefferson Avenue, Columbus, Ohio. Herbert S. Miller, electrical engineer, Diehl Mfg. Co.; residence, 1025 West Jersey Street, Elizabeth, N. J. William D. Pomeroy, electrician, Akron Electric Mfg. Co., 1106 South Main Street, Akron, Ohio. Thos. Byrd Whitted, electrical tester, The General Electric Co.; residence, 211 State Street, Schenectady, N. Y. The returns from the nomination blanks sent in by the membership were canvassed and the following gentlemen were announced as the council nominees: For president, Dr. Arthur E. Kennelly; for vice-presidents, J. W. Lieb, Jr., Charles F. Scott, L. B. Stillwell; for managers, C. O. Mailloux, S. Dana Greene, C. S. Bradley, W. D. Weaver; for secretary, Ralph W. Pope; for treasurer, George A. Hamilton. The council appointed Dr. F. A. C. Perrine to fill out the unexpired term of Mr. W. F. C. Hasson, who has resigned from the office of manager on account of his removal to the Hawaiian Islands. The regular election will proceed after the distribution of the ballots early in April, and the result will be determined at the annual business meeting which will be held in New York City, Friday, May 16, 1899. The council decided to hold the fifteenth general meeting at Boston during the last half of June, the exact date to be fixed by the Executive Committee.

PROPOSED PERMANENT COMMERCIAL AND INDUSTRIAL EXHIBITION IN NEW YORK.—A bill has been introduced in the legislature at Albany, N. Y., to incorporate the Industrial and Commercial Exposition Company of New York, which proposes to establish in the city of New York a permanent Commercial and Industrial Exposition, with a floor space one-third greater than the entire floor space of the World's Fair at Chicago, and over twice that of the Centennial of 1876 at Philadelphia. In addition to this it is proposed to build within the exposition buildings an auditorium with seating capacity in excess of that of Madison Square Garden. The bill incorporates C. O. Baker, Jr., Frederick Boos, William C. Breed, Charles Bright, Frederick Bright, David S. Brown, Thomas Brydon, William Cauldwell, Henry Chapin, Jr., Frederick W. Cole, R. Lindsay Coleman, Charles W. Colton, J. Clark Curtin, Edward L. Cushman, R. M. Cushman, James B. Dill, John A. Dohrman, James Drew, J. Elliott, Charles J. Follmer, W. H. Garrison, A. Wardner Harrington, Sylvester C. Hill, William Homan, Isaac G. Johnson, Andrew H. Kellogg, Edward J. Kern, Charles Knapp, Lee Kohns, Daniel Lewis, Paul Libby, William Luhmann, Lucius McAdam, John Jay McKelvey, W. A. Manda, F. W. Mattecks, George W. Millar, John H. Mooney, William C. Moore, Eugene F. Perry, Frank M. Peters, Samuel P. Porter, George L. Putnam, Fred A. Ringler, James Rowland, John N. Scatcherd, Paul Sonntag, A. G. Spalding, C. A. Stevens, J. Howard Sweetser, John F. Talmage, Seth S. Terry, L. C. Warner, James M. Waterbury, Louis Windmuller, Franklin Wiley, C. C. Wille, Daniel F. Wilson, Hermann Wippermann and William H. Yale as the "Industrial and Commercial Exposition Company." The company is to begin business with a capital of $5,000,000, divided into $10 shares, with power to increase the same to $10,000,000 and is authorized to issue $20,000,000 bonds. The company cannot commence business with less than $1,000,000 capital paid in. The company is authorized to acquire, by purchase or by condemnation proceedings, such real estate and to construct thereon such buildings as it may deem necessary to establish and carry on international, national, state, city and other expositions of periodical and permanent character, and for the conduct of all legal and proper business. It may grant or lease to the United States Government, or the government of any state or foreign country, or the commissioners, representatives, or agents of the same, or to any person, firm, or corporation, either native, domestic, or foreign, any part of its real estate for the purpose of maintaining exhibitions. Mr. C. O. Baker, Jr., the incorporator first named, is the president of the Electrical Exhibition Company, which will hold an exhibition at Madison Square Garden during the month of May, reference to which was made in the last issue of THE ELECTRICAL WORLD AND ELECTRICAL ENGINEER.

THE WAR TAX ON TELEGRAMS.—At Albany, on March 24, Mr. Thorn introduced in the Assembly a bill forbidding telegraph corporations to charge for messages a sum more than that charged prior to June 1, 1898. The object of the bill is to compel the company, instead of the patron, to pay the United States war tax of 1 cent on each telegraph message.

INDUSTRIAL APPLICATION OF ELECTRIC WAVES.—Prof. Lodge showed recently that drops of mercury under oil can be made to unite with each other by subjecting them to the action of electric waves. This naturally suggests the application of electric waves in certain metallurgical operations in which great trouble is encountered from the fact that the mercury divides into minute globules which will not join. As electric waves are so easily produced it might be worth while to try this. Prof. Lodge also said that the Scotch mist could be converted into rain by means of electric rays and that most fumes can be precipitated, but he does not think that an electric charge would have any favorable effect on London fogs.

OPENING NEW SUBMARINE CABLES IN THE PHILIPPINES.—Washington advices state that cable communication is being rapidly opened among the islands of the Philippines. The opening of the cable from Manila to Iloilo was announced on March 21 in a message to Gen. Greely from Manila. A cable has heretofore run from Manila to Capis, on the island of Panay, and before the insurgent uprising communication with Iloilo was maintained by a land telegraph from that point. The station at Capis has been discontinued and the cable has been swung from there around the northeast end of the island of Panay to Iloilo, making a direct line between Iloilo and Manila. Gen. Greely has also been informed that the cable has been opened from Iloilo to Baccolod on the island of Negros, and it is expected to soon open the land line from Baccolod, on Negros, to Escalante, from which place a cable extends to Suburan on the island of Cebu.

NERNST LAMP.—Our esteemed London contemporary, *Electrical Engineer,* is disturbed over the pre-eminence awarded to Americans as inventors and waxes sarcastic, as follows: "There is an ingrained idea in the minds of all modern people, with the exception of a few 'dry-as-dusts' who go outside the beaten tracks for information, to take for granted that America was discovered by Columbus and that universal gravitation was discovered by Newton. It is probable that a wiser man than our modern philosopher, he who said 'there is nothing new under the sun,' is correct also as regards these two assumptions, for it is practically certain that America had been discovered before the time of Columbus, and that Newtonian philosophy had been formulated by earlier writers. But, even if this is so, it does not detract from the value of the work of either Columbus or Newton, for they discovered anew, and gave their discoveries as a commencement of ıe development of modern progress."

PHOTOGRAPHING SOUND WAVES.—A special despatch from Madison, Wis., of March 24, says: Prof. R. W. Wood, of Madison, has succeeded in making photographs of waves of sound in air. The sound-wave is furnished by the crack of an electric spark, and it is illuminated and photographed by means of the light of a second spark, which flashes between two magnesium wires at some distance behind the first, and at an interval of about one-ten-thousandth of a second after the first spark. The sound-wave is thus caught before it has got out of the field of the instrument, although moving with a velocity of 1000 feet a second. The wave appears as a thin circle of shadow with a light border, being simply a sectional view of the rapidly diverging spherical shell of condensed air constituting the sound-wave. By placing a glass plate near the point where the wave starts the reflected wave or echo has been photographed, which appears as a circle with equal but opposite curvature. These waves were observed by Topler, a German physicist, a number of years ago, but they have never been photographed before.

MUNICIPAL OWNERSHIP IN KANSAS has been quite a craze, but it is the bondholders now who are often doing the crazing, on account of their inability to get back the money invested. A special despatch from Kansas City of March 29 says: The citizens and Councilmen of Attica, Kan., met last night and discussed the question whether it would be better to arbitrate with the bondholders or to move the town. The town is and has been for several years carrying an indebtedness of about $33,000, including old sugar mill bonds and interest. It was decided that if the matter cannot be adjusted for the amount the town is able to pay the citizens will move their business houses and residences to a piece of ground about a quarter of a mile south of where they now stand. The leading business men are in favor of moving. The scheme of moving a town to escape indebtedness is not original, Ness City, the county seat of Ness County, having practically decided on that method of unloading her burden of debt last week. A contractor has offered to move every building in Ness City to a new site nearly a mile away for half of the city's indebtedness. Half a dozen other Kansas towns are now debating whether it will not be cheaper to move than to pay bonds.

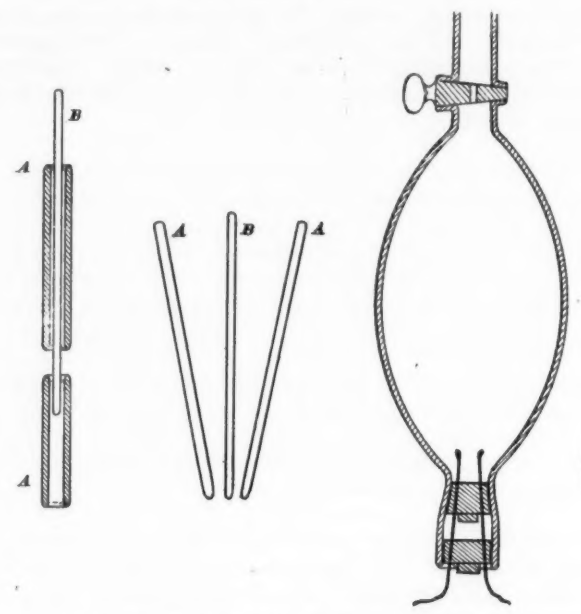
LETTER TO THE EDITOR.

The Nernst and Other Lamps.

To the Editor of Electrical World and Electrical Engineer:

Sir—I note your correspondent's communication regarding an electrolytic lamp, in your issue of March 11. Some years since the writer designed a lamp, as per Fig. 1, in which A A^1 are hollow carbons, and B a rod of magnesia or other earthy compound. As the rod deteriorates in use, it is pushed forward by the lamp trimmer when necessary, or it can be fed very slowly by the mechanism of the lamp. With this form of lamp a long or short arc could be used, either a smaller or larger part of the current passing through the rod. It is evident that the arrangement should give a very intense illumination, and was expected to overcome the fluctuation in light common to lamps at that time.

A higher voltage could also be used than with the ordinary lamp. It was also intended to experiment with ordinary carbons containing an admixture of the earthy oxide, and with carbons having a core



THREE EXPERIMENTAL TYPES OF ARC LAMPS.

of the same. The objection, however, in these cases is that the carbonaceous material would burn out faster than the oxide. In another construction, the oxide forms the outer tube, and the carbonaceous material the core.

The writer patented a form of lamp as per Fig. 2, in which the two carbons, A A^1, are fed toward each other at an angle, with the refractory rod, B, between. The rod is fed as in the previous case, by the attendant or by slow mechanism. This form should give a brilliant light free from shadows below, due to the lower holder for the carbon.

At this early date the enclosed arc was unknown, and it would be interesting to try the above arrangements in the enclosed globe, as it is evident the life would be much prolonged and the light would be intense and of whiter character than that of the ordinary arc.

The recent work of Nernst and others warrants the writer in mentioning certain experiments which it was intended to carry out some years since in this line of work. For this purpose suitable ap-

paratus was purchased, and a lamp constructed in 1885 or 1886, as illustrated in Fig. 3. The globe is closed by two glass stoppers at one end, and has a stopcock at the other. The object of the stoppers was to enable the quick and easy insertion or removal of the filaments of different kinds. The stopcock rendered available any degree of vacuum, and the insertion of different gases in the globe.

The stopper form of lamp was supposed to be original, but in reality they date back to early times, but were unknown to all except the early workers until introduced by the Westinghouse Company. Two or three forms are shown in Dredge's "Illumination." The space between the stoppers could be filled with insulating air-tight material. It was intended to experiment with filaments having cores of iridium and similar materials, with outer earthy coating, or vice versa; with a carbon core and refractory coating; with a filament composed of a mixture of these, and with other forms, some involving the use of the flashing process. For various reasons the experiments were not carried out. Several workers have since brought out lamps somewhat similar to those it was intended to produce, although they have not gone to the full extent.

The Nernst, Maxim and other proposed lamps are very interesting, but in my opinion they are not of the kind from which the light of the future will be produced. Such light will be soft and white, and will not tire the eyes so much as now. The illumination of the present lamp is produced by the brute force of the current, pure and simple. This is not the right way. Put a little brain into the form of the electric current and note the result.

Albert B. Worth.

Greenport, L. I., March, 1899.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

Dynamos, Motors and Transformers.

REFERENCES.

Rotary Converters.—A mention with very brief comments, of all of the more important articles which have recently appeared on converters, that is, rotary transformers. The same issue contains long abstracts of some of the recent articles, including the one of de Marchena.—Guilbert. *L'Eclairage Elec.* March 4.

Calculation of the E. M. F. of a Polyphase Dynamo.—A communication criticising the hypothesis made in connection with converters, that the voltage around the periphery of the collector is represented by a sinusoidal curve. He questions the correctness of this and favors the method described in Thompson's book.—Benenson. *L'Eclairage Elec.*, March 4.

How to Make a Sewing Machine Motor.—A description, with numerous working drawings, describing how a small sewing machine motor may be built without castings.—Poole. *Sc. Am. Sup.*, March 11.

Lights and Lighting.

Filament of Carbide of Silicon.—A new filament, which, from reports seems to have very valuable properties, is being introduced in England under the name of the Premier filament, an invention of a German named Langhans, a brief description of which is given in the London electrical journals, March 10. The filament consists of carbide of silicon coated with silicon and carbon and is said to be capable of standing a higher temperature than pure carbon, and therefore of making a more efficient incandescent lamp. Cellulose is treated with sulphuric and phosphoric acids until a gelatinous semi-liquid substance is obtained, with which silicon in the form of a fine amorphous powder is incorporated. This material is then squirted through a fine aperture in the form of a continuous thread, which is hardened in the usual way, and after being washed and dried it is carbonized by the usual process, except that the silicon must be protected from nitrogen, for which reason the forms on which the threads are wound are surrounded by a mixture of carbon powder and titanic acid; the highest temperature attainable must be held for a sufficient time for the silicon and carbon to combine. After carbonizing, the filaments are flashed in a vapor of silicon and carbon and they are then ready to be made into lamps. This material has a very refractory nature, and it is said that there is no falling off in the light and practically no blackening of the bulbs during the life of the lamp. The claims of the inventor, which have been substantiated by the report of Prof. Ayrton and by later experience, are that a lamp starting with an efficiency of 2.8 watts per amylacetate candle, or about 3.1 watts per English candle, will run for 600 to 800 hours without any material decrease in the light emitted, increase in watts per candle, or blackening of the bulbs. On this estimate there would be a saving of about 25 per cent. in lighting bills.—London *Elec.* and *Elec. Eng.*, March 10.

Power.

REFERENCES.

Utilizing the Power of the Rhine.—An abstract of an article from *Le Genie Civil* concerning the project which has already been noticed in the "Digest," of utilizing the whole power of the Rhine in Switzerland, the cantonal government of Zurich undertaking the work. The whole scheme would involve an expenditure of more than five million dollars and the total power at seven different stations along the river would be 58,000-hp available at the turbine shafts. At present about one-half of the power is utilized at the famous falls, while at Rheinfelden the entire capacity of the river will be used by the large station now nearing completion. It is intended to use the three phase current at 10,000 volts. The charge to the consumer would be about half the cost of steam power.—*Eng. Mag.*, March.

Electric Light from Refuse.—According to a note in the Lond. *Elec.*, March 10, it has been decided to install a combined electric lighting and refuse destruction plant for the Hackney Vestry as recommended by Mr. Hammond, who will be the consulting engineer. The cost is to be over one million dollars. The three-wire continuous current battery system will be used, and two sets of generators of 1000-hp each are recommended to start with.—Lond. *Elec.*, March 10.

Transmission and Distribution by Alternating Current.—The continuation of the long article noticed in the "Digest" March 4. The present portion refers to the properties of induction machines.—Leblanc. *L'Eclairage Elec.*, Feb. 18 and March 11.

Electrically Driven Air Pump.—An illustrated description of some three-throw electrically driven air pumps for the condensing plants of the Glasgow central station. There ar no foot valves, nor are the buckets fitted with packing rings.—Lond. *Engineering*, March 10.

Steam Mains.—A short article on steam mains for electric supply stations. Sommerfield. Lond. *Engineering*, March 10.

Traction.

REFERENCES.

Automobiles in France.—An abstract of what is said to be an excellent review of the whole subject in *La Revue de Mechanique*, with special reference to the recent exhibition at the Tuilleries.—Barbet. *Eng. Mag.*, March.

Rail Bonding.—A reprint of the report to the Geneva meeting of the International Tramway Union. The present portion merely describes the various methods used in Europe.—*L'Elec.*, March 11.

Glasgow.—A brief illustrated description of the municipal railway plant.—*St. Ry. Rev.*, March 15.

Installations, Systems and Appliances.

Standard Frequencies.—A report has recently been made by the committee of the English Institution of Electrical Engineers in which, after collecting a number of opinions both in Europe and in America, it recommends unanimously the adoption for general purposes of a frequency of 50 periods per second, as this is considered to be the best suited for ordinary cases of mixed distribution for power, incandescent and arc lamps. For the transmission of power on a large scale a standard frequency of 25 periods is recommended. A frequency of 100 periods is also suggested for exceptional cases of house-to-house transformer supply in scattered districts. Editorially the Lond. *Elec.*, March 10, while endorsing the first two suggestions, thinks that the last concerning the frequency of 100 might safely have been omitted.—Lond. *Elec.*, March 10.

Effect of the Introduction of a 1.5 Watt Lamp.—Several statements showing the effect of the general introduction of an incandescent lamp requiring 1.5 watts per candle on the financial prospects of central stations. It is said that it would cheapen the light from 50 to 70 per cent. or make it equal to gas at 31 cents per thousand. The immediate effect on the station, however, would not be beneficial.—Lond. *Elec. Eng.*, March 10.

REFERENCES.

Multiphase Current Extension in the Vienna Station.—An abstract of a recent paper on the extension recently made to one of the Vienna stations, consisting in the addition of multiphase generators to the present plant, as it was desired to add multiphase current to that at present used. It consists chiefly of a discussion whether the two or three phase system would be best, and what changes would be involved. It was concluded to use the two phase current, and concentric cables; the chief reason seems to be that the generators are more easily changed for two phase currents than for three phase.—Stern. *Zeit. fuer Elek.*, March 5.

Canterbury.—A long illustrated description of this plant in which the three-wire continuous current system with 440 volts between the outers, is used. A feature of interest is that the company made connections to the consumers' premises free of charge, provided that the requested connection was made while the trench in which the mains were laid was still open, and in this way the plant started the first night with a load of over 3000 lamps.—Lond. *Elec. Rev.* and *Elec. Eng.*, March 10.

Bankside Station in London.—A brief illustrated description of this power station of the City of London Electric Lighting Co., the load for which is of an extraordinary character on account of the London fogs. The plant contains almost every variety of generating machinery. Some load curves are also given.—Lond. *Elec.*, March 10.

Breslau.—Long tabular extracts concerning the cost of operation of this station.—*Elek. Zeit.*, March 9.

Wires, Wiring and Conduits.

10,000-Volt Cable Tests.—The 10,000-volt transmission line of the Bozen-Meran transmission plant, the length of which is 37-km, passes through a number of villages where there were objections to the use of overhead wires carrying such currents; it was therefore desirable to use underground cables, but as none of them had been used for such high voltages it was necessary to make some experiments. These are described in an article by Mr. Hassold, in the *Elek. Zeit.*, March 9. Two sets of cables were laid from the generating station to the line which it joins at some distant pole. One of these cables was insulated with vulcanized rubber and the other with a material called cabelite, which has many advantages in common with rubber and is cheaper. Three-wire cables were used, each wire having a cross-section of 35 sq. mm. The results are given in a long table, but the description is not complete and no general conclusions are drawn. It appears, however, that the cabelite had a resistance of only about a quarter of that of hard rubber. Both cables were laid in the ground without any special objection and were connected to a line through lightning arresters. They have been in use since September without develop ng any effects.—Hassold. *Elek. Zeit.*, March 9.

Electro-Physics and Magnetism.

High Resistance Alloy.—A note in the Lond. *Elec.*, March 10, states that the "Beacon" wire for high resistances has a specific resistance of 85.13 (presumably microhms per cu.cm.) at 20° C., which is considerably higher than that of maganin and about equal to that of Krupp's alloy. The specific gravity is 8.1; the temperature coefficient 0.0007; the metal can be heated to 650° C. without fear of injury; it does not lose its springiness when wound in a spiral, does not become "cold brittle" and does not deteriorate in open or damp situations.—Lond. *Elec.*, March 10.

Oscillatory Character of Accumulator Discharges in Tubes.—It has been found by Cantor, according to his article in the *Wied. Ann.* No. 2, briefly noticed in *Science*, March 17, that the discharge through a vacuum tube by a large storage battery gives off electric waves, showing that the discharge must be either oscillatory or intermittent, which is contrary to prevailing notions. He determined this by means of a coherer made of powdered metal. (Possibly some interesting results might be obtained by passing such a current through an induction coil, as it was by a similar observation that Wehnelt discovered his very interesting electrolytic interrupter).—Cantor. *Wied. Ann.* No. 2.

Electric Waves Along Wires.—Mr. Somerfeld in the *Wied. Ann.* No. 2, publishes a further development of the very complete theory of J. J. Thompson for the case of a wire surrounded by a cylindrical conducting shell, with reference to the electric waves along such wires. A brief abstract is given in *Science*, March 17. He also gives some interesting numerical results which he has calculated. Among these he states that electric waves 30 cm. in length travel along a copper wire 5 mm in diameter at a velocity which is less than that of light by one part in 30,000, and the amplitude falls to 1÷2.8 of its initial value at a distance of 1.5 km. Electric waves of 100 cm in length travel at abou' three-fourths of the velocity of light along a platinum wire 0.004 mm. in diameter, and their amplitude falls in the same proportion as given above at a distance of only 17 cm.—Somerfeld. *Wied. Ann.* No. 2.

REFERENCES

Constitution of the Electric Spark.—A long abstract of a Royal Society paper, describing investigations made to measure the velocity of diffusion of different metallic vapors in the path of the spark.—Schuster and Hemsalech. *Sc. Am. Sup.*, March 18.

Magnetic Properties of Nickel Steels.—An abstract of an article in the *Jour. de Physique*, January, in which an attempt is made to explain the curious magnetic properties of nickel steels discovered by Guillaume. It is followed by a reply by Guillaume.—Houllevigue. *L'Eclairage Elec.*, March 4.

Electro-Chemistry and Batteries.

Electrometallurgy.—A brief abstract, more in the nature of a synopsis, of what appears to be a very long article by Prof. Threlfall in the *Australian Mining Standard*, the date of which is not given. The first portion is devoted to the theory of electrolysis and the second to its practical applications. The following information may be of interest by itself. In electroplating he has always obtained the best results with a current density of 10 amperes per square foot; traces of colloids, such as glue or tannin, when present in the electrolyte generally improve the deposit. In the electrolytic refining of copper the use of copper oxide for renewing the electrolyte plays an important part. The Heroult aluminium process he states has been abandoned in favor of one in which aluminium sulphide is used, but this statement is said, in the abstract, to be incorrect. Concerning zinc ores it is stated that the deposition of spongy zinc has been overcome by Siemens & Halske by means of violent agitation of the electrolyte with air. It seems from the abstract that the article was written some time ago and is now somewhat discounted by subsequent developments.—Lond. *Elec. Rev.*, March 10.

Victoria Accumulator.—A brief account with tables of data and dimensions concerning the Victoria accumulator, is given in the Lond. *Elec. Rev.*, March 10. The accumulator is said to be the outcome of many years experience, and its chief features are that the active material is a compound of lead salts with organic materials which is claimed to increase the voltage, or more correctly to maintain the difference of potential higher during discharge; on a seven-hour discharge, for instance, the voltage does not fall below 2 volts for half the time. The internal resistance is low. The chemical reactions are complicated and are not described, nor is it stated what the organic material is. The active material is said to be capable of standing extremely high charges and discharges. The plates are so constructed that the active material is locked in them. Their manufacture is said to be cheap and rapid. The cell, 11 x 7 x 4 inches, containing nine plates, has a capacity of 37 watt-hours per kilogram of plates at the rate of 3.3 watts per kilogram of plate. A curve showing the capacity in watt hours for given rates of discharge in watts per kilogram of plate is given. For 2 watt-hours it is 50 watt-hours, and for 10 it is 24 watt-hours. When discharged at the rate of 70 watts this cell has a capacity of 368 watt-hours; its weight is 31.5 pounds.—Lond. *Elec. Rev.*, March 10.

Gas Accumulators.—Mr. Nansouty in *L'Elec.*, March 11, writes in rather glowing terms on the future of accumulators in which the materials consumed are gases under great pressure. According to the researches of Cailletet and Collardeau, 1 kg. of spongy platinum will yield 56 ampere hours at a pressure of 580 atmospheres; the current may easily reach 100 amperes per kg. He suggests using the gases highly compressed or even liquefied; for gases he suggests the active ones, such as chlorine, ammonia, ozone, hydrogen or acetylene. A couple might be formed of chlorine and hydrogen, chlorine and ammonia, ozone and hydrogen, or nitric acid and hydrogen. A couple of chlorine and hydrogen with hydrochloric acid as the liquid will have an e. m. f. of 1.37. He considers this the coming motive power. The article is somewhat visionary in

character and contains no information of a practical nature.—Nansouty. *L'Elec.*, March 11.

Carbon Consuming Batteries.—A recent paper was read in England by Mr. Cooper on such batteries and their possibilities, a brief abstract of which is given in the Lond. *Elec.* and *Elec. Rev.*, March 10. It seems to consist chiefly of descriptions and discussions of the various batteries which have been suggested, all of which have already been noticed in the "Digest." In comparing the efficiencies he calculates that, assuming the absolute mean efficiency of a steam plant for generating electrical energy to be 6 per cent., the corresponding figure of a battery under the same conditions would be about 73 per cent. If coke could be voltaically oxidized to carbonic acid gas, and if the electrolytic plate opposed to the carbon did not introduce additional expense, he calculates that it is possible to effect a saving of 30 per cent. in the cost of a kw hour. (This does not seem to agree with the previous statement, and the discrepancy is not apparent from the information in the abstract.) In order that the consumer may derive much benefit from such a battery, a reduction in the capital expenditure must be effected as well as in the coal bill. The difficulties in attempting to solve the problem of direct conversion are due to the following: the insoluble nature of the carbon, the scarcity of electrolytes among carbon compounds, the inability of carbon to act as an ion in such organic compounds as are electrolytes, and the electronegative character of carbon. Carbon monoxide might be used in place of carbon, but the possible voltage is lower than that theoretically obtainable from carbon; there are then also difficulties in finding electrolytes in which this gas acts as an ion.—Lond. *Elec.* and *Elec. Rev.*, March 10.

REFERENCES

Accumulators.—The beginning of a long extract with numerous illustrations, from the recent book on accumulators by Schoop.—Loppe. *L'Eclairage Elec.*, March 4 and 11.

Production of Chlorates.—A translation in abstract of the article on chloride of calcium solutions, noticed in the "Digest," July 30.—Oettel. Lond. *Elec. Rev.*, March 3.

Electrolysis of Zinc Chloride Solutions.—An abstract of the article noticed in the "Digest," Aug. 6.—Foerster and Guenter. Lond. *Elec. Rev.*, March 3.

Units, Measurements and Instruments.

Wehnelt Electrolytic Interrupter.—At a recent meeting of the German Society, Messrs. Kallir and Eichart described experiments in the use of this remarkable device (see "Digest," Feb. 25 et seq.) with an alternating current in the primary circuit. As the frequency of the breaks is so great it was found quite possible to operate a coil with commercial alternating currents which in their particular case had a frequency of 84. The sparks obtained were of the full length of those given by the ordinary break and condenser. Apparently the secondary discharge takes place only during a part of the half period, and that they are sudden; the currents are not sinusoidal like those of the original one. Concerning the nature of the break, no definite conclusions can be given. From a stroboscopic examination of the light in the interrupter and of the spark in the secondary circuit, it seems that the passage of the current takes place only during a certain part of the period when the voltage has reached a sufficiently high value. Black spots which are very sharply defined, appear on the synchronously revolving disc, and as compared with the white part of the disc they are much darker than when illuminated by an alternating current arc. No further particulars are given.—Kallir. *"Zeit. fuer Elek.*, March 5.

Instrument for Measuring Small Induction Coefficients.—A longer abstract containing the theory and a reproduction of an illustration of the apparatus, of the article noticed in the "Digest" last week. It cannot be clearly described without reference to the mathematical data. It appears, however, that the present author's phase indicator is an instrument containing three coils, two of which are in parallel planes and the third in a plane perpendicular to these. Inside of the space of all of these is a cylinder of aluminum which is deflected when there is a phase difference. It is said to be very sensitive and capable of detecting a difference of a second of arc in the phase shifting. When there is no torque produced in the apparatus, an adjustable resistance gives a direct measure of the phase difference in time.—Martienssen. *Elek. Zeit.*, March 9.

Measuring the Brilliancy of Light Sources.—A somewhat roundabout method for measuring what is usually termed the intrinsic brightness of sources of light, that is the candle power per unit surface of the light giving source, is described by Mr. Jenko in the *Wied. Ann.* No. 13, 1898, a brief abstract of which is given in *Science*, March 17. What the objections are to the usual method of measuring the candle power and dividing it by the surface of the emitting source, is not stated in the abstract. The method which he uses is to illuminate a screen of known area by a light of known candle power, the distance between the light and the screen being known. The light given off by this screen is then compared by means of a photometer with that given off by the source to be determined; the luminous area of the source is then measured and its intrinsic brightness calculated in terms of the illumination of that screen. What the advantages are is not clear.—Jenko. *Wied. Ann.* No. 13.

Measurements of Long Telephone Circuits.—A long article in the form of a contribution from the government telegraph department of Germany, in which the author describes and discusses a method of making measurements of telephone circuits by means of alternating currents. The chief object seems to be to measure the capacity and self-induction, and the method seems to be based on a connection of the two wires simultaneously to the source, and then either to earth them at the other end or insulate them from the earth. It is said to give the results with considerable accuracy.—Breiseg. *Elek. Zeit.*, March 9.

Heating of High Voltage Cables.—A discussion of the editorial, referring to the measurements of the energy losses in high voltage cables, which was noticed in the "Digest," March 18. The author believes that the method of Rosa and Smith is hardly applicable to such cases on account of the very large coils which would be required. He believes that a good method adapted for practical purposes is still wanting. For a given case he gives the loss in watts and that due to the Joule effect in the insulation, for a cable at different voltages.—Eisler. *Elek. Zeit.*, March 9.

REFERENCES.

German Photometry Committee's Report.—A reprint from the *Journal of Gas Lighting*, Jan. 24, of a translation in abstract of the Committee's report at the Nurenberg meeting in 1898. It has already been referred to several times in the "Digest."—*Prog. Age*, March 15.

Determining the Loss of Energy in Dielectrics.—A claim that he had devised and used two years ago, the method recently described by Rosa and Smith (see "Digest," March 4); a portion of the description which was published at that time, is reproduced.—Heinke. *Elek. Zeit.*, March 9.

Use of the Silver Voltameter.—A longer and fuller abstract of the article noticed in the "Digest," March 11.—Kahle. *Elek. Zeit.*, March 9.

Measuring Instruments.—Well illustrated descriptions of recent improvements, taken from patent specifications.—Armagnat. *L'Eclairage Elec.*, March 4.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—Mr. Marconi, whose name is so prominently connected with a system of wireless telegraphy by means of Hertzian waves, recently read a paper before the Institution of Electrical Engineers which is reprinted in full in the Lond. *Elec.*, and begun in the Lond. *Elec. Eng.*, March 10. It includes good diagrammatic illustration of the system and consists largely of a description of his work including some brief data. When long distances are to be bridged over and it is not necessary that the signal should be sent in one definite direction, he uses as a transmitter simply an induction coil without a hammer interrupter, but with a key in the primary circuit, the secondary coil discharging between two spheres, one of which is grounded and the other is connected to that vertical wire which plays such an important part in his system. If it is necessary to direct a beam of rays in a given direction, he prefers an arrangement similar to a Righi oscillator and a cylindrical parabolic reflector, placed behind the spark gap. The diagram for the receiver is shown in the adjoining illustration. The only form of coherer which he found trustworthy and reliable for long distance work, is shown in this diagram and consists of a simple glass tube 4 cm in length in which two metal pieces j^1 and j^2 are tightly fitted and are separated by a small gap partially filled with a mixture of nickel and silver filings. This forms part of a circuit containing the local cells and a sensitive telegraph relay actuating another circuit which works a trembler or decoherer p, and a recording instrument h. When these filings are influenced by electric waves their resistance is reduced from infinity to between 100 and 500 ohms. One end of the coherer is connected to earth and the other to a vertical conductor similar to that of the

transmitter, or if reflectors are used, a short strip of copper is connected to each end, the length of which must be carefully determined. All the electromagnetic apparatus are shunted with non-inductive resistance so that there is no sparking at contacts; he considers that his success is due greatly to this, as sparks seem to affect the coherer. Much has been said about coherers being unreliable, but this has not been his experience, for if properly constructed and used with a suitable receiver he says that they are just as certain in their action as any other electrical apparatus, like an electromagnet or an incandescent lamp. He discusses at considerable length the object and function of the vertical wires which, as is well known,

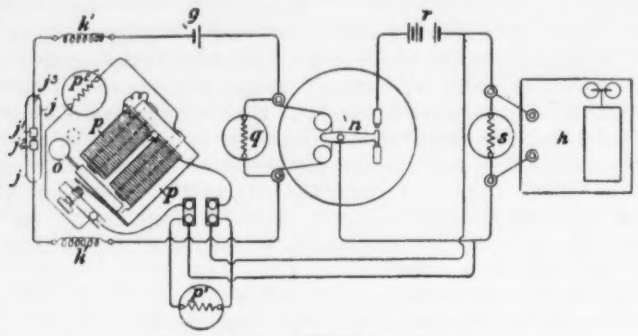


DIAGRAM OF RECEIVING CIRCUIT.

form such an important part of his system. He has found that the distance to which signals can be transmitted varies approximately with the square of the distance of the capacities from the earth, or perhaps with the square of the length of the vertical conductors. Other conditions being equal, a vertical wire 20 ft. long at the transmitter and receiver is sufficient for communicating one mile, forty feet for four miles, eighty feet for sixteen miles, and so on. An installation is now working over a distance of 18 miles with vertical wires of 80 feet. This law is applicable only when vertical wires are used and it then becomes easy to telegraph between positions screened from each other by hills or by the curvature of the earth, in which cases it is a marked advantage to have this conductor thick or to have a capacity placed at the top of it. The correct explanation of the effect has not been given. He thinks there is little doubt as to the complete opacity to electric waves, of a hill three miles thick, or of several miles of sea water. He claims that it is not sufficient to use a horizontal wire as that is of no utility for long distance signalling (in this he differs from some German investigators). He believes the great gain by the use of the vertical conductor is due to the fact that the plane of the polarization of the rays is vertical, and they are therefore not absorbed by the surface of the earth which acts as a horizontal receiver. He then describes his more recent experiences. He found that by means of reflectors it is possible to project the rays in an almost parallel beam which will not affect any receiver placed outside of its line of propagation. This reflector system is applicable to warning ships by lighthouses not only of their proximity to danger but also to show them the direction from which the warning comes. In the installation from Alum Bay on the Isle of Wight, to Bournemouth, a distance of 18 miles, the poles are 120 feet high and consist usually of 7-20 copper wires, insulated with rubber; a 10-inch induction coil is used at each station worked by a battery of 100 dry cells, the current being 6 to 9 amperes at 14 volts. The discharge is between two spheres one inch in diameter, as he finds these better than the Righi apparatus; the length of spark is about 1 cm and the results are decidedly better with dull spheres than with polished ones. Experience of over 14 months has convinced him that there is no kind of weather which can stop or seriously interfere with the working of such an installation. The heights of the poles in this installation have recently been reduced to 80 feet, and an average of fully 1000 words are daily transmitted each way. The transmission from a yacht, in some races last summer, is briefly described. The distance was sometimes 10 miles and the reports of the races were enabled to be published in a daily paper long before the yachts returned to the harbor. With a height of 80 feet on the ship it is possible to communicate over 25 miles, even though the curvature of the earth intervened. In the installation from the yacht, Osborne, to the Osborne House, 1¾ miles, the average speed of transmission was about 15 words per minute. It seems that it is quite easy to learn how to use the apparatus, as several of the crew of a vessel could send and receive messages after two days instruction. Permission has now been received from the French Government to telegraph across the channel from Folkestone to Boulogne, a distance of 32 miles. His system has been in use by the Italian Navy for more than a year and distances of 19 miles have been bridged between war vessels.—Marconi. Lond. *Elec.* and *Elec. Engr.*, March 10.

The discussion is abstracted briefly in the Lond. *Elec. Rev.*, but seems to contain nothing of importance. In an editorial reference that journal questions whether Marconi is really dealing with true Hertzian waves or with electrification as known to Franklin, the remark being based on the statement that dull balls were found better than highly polished ones for the spark discharge. Attention is also called to the early experiments of Edison in wireless telegraphy described in 1892 in which stress was also laid on the importance of vertical conductors.

Cheapening Telephone Traffic.—There is a long discussion of the subject of what is the best method of charging for telephone service, by Mr. Hellrigl, in the *Zeit. fuer Elek.*, March 5. The system proposed would be too complicated for use in this country, although it seems to be a more rational method than the usual one of fixed charges. He divides the service into three parts, the local, that between neighboring places, and that over long distances. The charge for the local service is made up of three parts, the first being a constant depending on the size of the town or the population (would it not be more rational to say the number of subscribers?); also on the distance from the subscriber to the central station, and lastly on whether the subscriber can connect with the suburbs or the long distance lines. The second component is independent of the first and depends on the nature of the apparatus. The third is a percentage of the sum of the other two, and depends on whether the subscriber belongs to a class for which the traffic is small, medium or great; also on whether the 'phone is used during the day or the night hours. Several examples are worked out. For service with neighboring villages within 30 miles, he suggests a fixed charge for a three minute conversation, although in exceptional cases the charge may be of three different grades; urgent calls are charged double or three times the regular amount. For long distance service he recommends a uniform charge for three minutes for distances over 30 miles, and he does not recommend varying this with the distance. (While such a division of charges would no doubt be more equitable than the methods used in this country, it would be far too complicated.) Hellrigl. *Zeit. fuer Elek.*, March 5.

Government Telephony in London.—It seems that the British Postoffice is about to establish a telephone service in London in competition with the present one, which is owned by a company; it also intends to encourage other municipalities to compete with the respective companies in the provinces. Ten million dollars are about to be devoted as an initial sum to start this work.—Lond. *Elec.*, March 10, discusses this editorially at some length; it does not favor the project.

The subject is also discussed editorially in the Lond. *Elec. Eng.* and *Elec. Rev.*, March 10.

A reprint of the proceedings of the House of Commons, concerning the telephone question, is published at some length in the Lond. *Elec. Eng.*, March 10.

MISCELLANEOUS.

Prize for an Essay on Direct Conversion Processes.—According to the Lond. *Elec.*, March 10, Mr. Kaueffer, a German, left a legacy from which a first prize of $750, and a second of $375, are to be awarded for the best essay on the question of "What Practical and Useful Processes are Available to Transform Heat Directly (without motors) into Electro-Dynamical Energy?" Some prominent German scientists and electricians have been chosen as judges. The competition is to be international but the essay must be written in German and must be sent to the Verein Deutscher Ingenieure, 43 Charlottenstrasse, Berlin, Germany, before the last day of the present year. Further particulars can be obtained at that address.—Lond. *Elec.*, March 10.

REFERENCES.

Lightning Protection.—An illustrated article in the nature of a short treatise on the historic and modern lightning rod and its incorrect application. A letter from Benjamin Franklin dated 1752 describing his kite experiment is reprinted.—Hopkins. *Sc. Am. Sup.*, March 25.

The Electric Construction Company's Works.—A well illustrated description of the works of this company which have recently

ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN

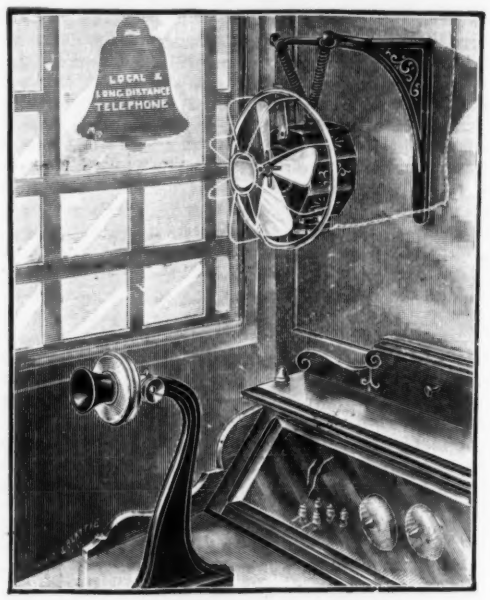
been extended and which are believed to be the largest of the purely electrical manufacturing plants in England.—Lond. *Elec.*, March 10.

Electricity at the Paris Exposition.—An illustrated article showing the condition of the work and the plans and projects, pointing out the importance of the use of electricity; more than 20,000-hp will be used for lighting alone and 10,000 for motive power.—Dary. *Eng. Mag.*, March.

New Edison Fan Motor Outfits.

The Edison Manufacturing Company, of New York and Orange, N. J., is placing on the market several fan outfits for the coming season. Among these is an improved iron clad outfit, carrying a 7-inch fan with a guard, and operated by a battery of three Edison Lalande cells. The speed is about 1200 revolutions a minute; the motor is of an efficient type and the battery will run for 150 hours on one charge. The 9-inch Edison fan motor has also been improved this season. The motor is much more efficient and will run at about 900 revolutions a minute on a little less than two amperes of current when using the battery supplied with it, consisting of four Edison Lalande cells. The greatest attention has been given to the elimination of all unnecessary friction in the moving parts. A 9-inch fan motor similar in construction to the battery fan motor, is wound for 110-120-volt direct current. It is provided with three speeds; and will run 1400, 1600 and 1850 revolutions per minute, respectively.

A convenient outfit for use in a telephone booth, is the very latest novelty exploited by the Edison Company. Its use is not limited to any time or season, as the telephone booth is usually close, hot, ill-ventilated and uncomfortable at all times. The Long Distance Telephone Company, and several of the local Bell telephone companies are using this type quite extensively. This outfit, which



FAN MOTOR IN TELEPHONE BOOTH.

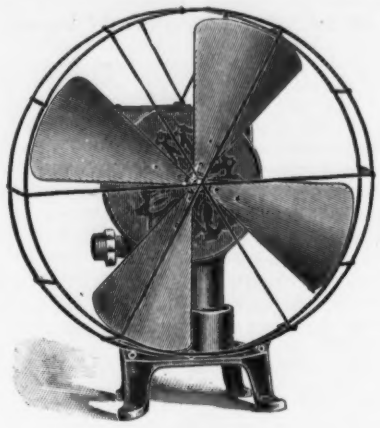
is shown in the accompanying cut, is designed for use on either 110 to 120-volt direct current circuits, or with a primary battery. It is noiseless and free from vibration, and has self-aligning, self-oiling bearings. It is suspended by a double spiral spring, from an ornamental bracket easily adjusted to the interior woodwork of a booth.

In motors for the 110-volt circuit, connection is made from the stop-and-start switch on the motor by means of the connecting cord to the nearest incandescent lamp socket. The switch on the motor is so arranged that the lighting of the booth lamp will start the fan, or the lamp can be lighted independent of the motor, if so desired. It costs no more to run both the lamp and the fan motor than to run the lamp only, and as neither need run while the telephone booth is not in use, the economy of the outfit is apparent.

When an office is not wired for electric light, or when the 110-120-volt direct current is not available an Edison Lalande battery of three cells may be used. Such a battery has a capacity of 150 fan hours, and renewals cost comparatively little.

Water-Power Fan.

The fan shown herewith is for use in cities and towns where a water pressure of 30 pounds or more can be obtained, and is suitable for counters, offices, bedrooms, etc. It is so arranged as to be inexpensively fitted up for operation with rubber hose for both service and waste, the inlet being threaded to receive the ordinary ¾-inch hose coupling. The fan has a ground tool steel shaft, hard



WATER POWER FAN.

brass-bushed bearings, and 13-inch blades of spring brass, nickel-plated and protected with a wire guard. It weighs but 9 pounds complete, and a 1-16-inch jet is stated to furnish sufficient supply.

This fan, known as the "Junior Water Blow Fan," is placed on the market by the Specialty Manufacturing Company, of Indianapolis, Ind.

A New Riker Delivery Wagon.

The electric delivery wagon illustrated herewith represents the latest development in vehicles of this class as produced by the Riker Electric Motor Company, 45-47 York Street, Brooklyn Borough, New York City. The weight of the vehicle, ready for operation, is

ELECTRIC DELIVERY WAGON.

3600 pounds, and its carrying capacity, in addition to the operator and delivery man, is 1000 pounds. The motive power is supplied by two motors of 2-kw capacity each, and the controller gives three speeds ahead and two back. The maximum speed is 9 miles an hour. On one charge of the storage battery the vehicle will run 30 miles on a level macadam road. The rear wheels are the drivers, and the steering is done by the front wheels. The wheel base is 68 inches and the tread 59 inches. The front wheels are 38 inches in diameter and provided with 2-inch tires, the rear wheels being of 42 inches in diameter and having the same size tires as those on the front wheels. A combination voltmeter and ammeter is provided to indicate the condition of the battery as to its charge. The vehicle is also provided with electric side lights.

NEWS OF THE WEEK.

Financial Intelligence.

THE AMERICAN TELEGRAPH COMPANY has declared a dividend of 2½ per cent., payable April 1.

THE CENTRAL SOUTH AMERICAN TELEGRAPH COMPANY has declared a dividend of 1½ per cent., payable April 8.

WESTINGHOUSE.—On April 1 the quarterly dividend of 1¾ per cent. is payable to preferred stockholders of record of the Westinghouse Electric & Manufacturing Company. Transfer books close March 25 and reopen April 3.

NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY has declared a regular quarterly dividend of $1.50, payable May 15. The New England Company has sold $500,000 5 per cent. debenture bonds, dated April 1, 1899, and payable April 1, 1919, to Adams & Co., Boston.

MISSOURI-EDISON ELECTRIC.—Large blocks of preferred and common stock and bonds of the Missouri-Edison Electric Company have been changing hands in the past few days, and the story that a deal is on for the sale of the pany's plants is gaining credence among the brokers. Negotiations which were on some time ago for the purchase of the Missouri-Edison properties were said to have fallen through, but, according to certain gossip, the deal has been revived.

CHICAGO CONSOLIDATED TRACTION.—It is stated that the $15,000,000 stock of the Chicago Consolidated Traction Company will shortly be listed on the New York Stock Exchange. This is the company which recently absorbed the Yerkes suburban electric lines with the exception of the Suburban Electric, which will probably be taken in later. It is stated that from the time of the consolidation up to March 10 the gross earnings of the constituent companies showed an increase of 15 per cent., while the operating expenses were reduced 10 per cent. Two power houses now suffice to furnish the current required, whereas three were formerly operated.

POWER FOR MANHATTAN ROAD.—There is a strong intimation from good sources that Manhattan Elevated will get its power for its electric equipment from the Metropolitan Company, and that this is part of the deal upon which the present bull movement is said to be based. Manhattan has been under pressure by bear interests several weeks, and it is supposed that there is also in the stock quite a large short interest, consequently the demand for Manhattan is expected to come from a pretty urgent lot of buyers for the next few days. A director of Manhattan says: "For the month of February the earnings of Manhattan increased $22,000 over the same month last year. One day during the month the company carried 664,000 passengers, which was the largest number carried for any one day in many months."

PENNSYLVANIA ELECTRIC VEHICLE COMPANY.—President W. W. Gibbs, of the Pennsylvania Electric Vehicle Company, has issued the following statement: "As there seems to be a misapprehension as to the relative status of the preferred and common stocks of the Pennsylvania Electric Vehicle Company, I make the following statement for the information of shareholders: The preferred stock is entitled to a dividend of 6 per cent. upon the amount paid in upon said preferred stock before any dividend shall be payable on the common stock. After 6 per cent. has been paid upon the amount paid in or called upon the preferred stock, then 6 per cent. shall be paid on the par value of the common stock before further dividends or payments are made on the preferred. After 6 per cent. has been paid upon the amount paid in on the preferred stock, and 6 per cent. has been paid upon the par value of the common stock, any further distribution of profits will be made, share and share alike, upon the face value ($50) of each." The capital of the company is $4,000,000 common and $2,000,000 preferred.

NORTH HUDSON OF JERSEY.—The New Jersey Title Guarantee & Trust Company, of Jersey City, acting as agent for the United Gas Improvement Company, of Philadelphia, has issued a circular letter to the owners of stock of the North Hudson Light, Heat & Power Company stating the terms upon which the stock of the latter company can be exchanged for bonds of the United Electric Company of New Jersey, which was recently incorporated, with a capital stock of $20,000,000. The United Electric Company has issued $20,000,000 of 50-year 4 per cent. gold collateral trust bonds. The letter says: "The holder of each $1000 of the stock of the North Hudson Light, Heat and Power Company will receive $875 in the bonds upon the surrender of the certificate and by the payment of $100 in cash on or before May 31." The United Gas Improvement Company agrees to sell to the stockholders of the North Hudson Company who avail themselves of the offer stock in the United Electric Company to an amount of 25 per cent. at par of their holdings in the North Hudson Company at $30 a share, the par value of each share to be $100.

ELECTRIC VEHICLE SUB-COMPANIES.—With regard to the relations between the Electric Storage Battery Company, the Electric Vehicle Company and the sub-companies, it is emphatically stated that there is no idea to make a monopoly out of the existing companies or those to be created. A uniform scheme in the establishment of subsidiary companies will be maintained solely for the purpose of bringing about the greatest economy in manufacture by this unity of interests. In every instance local corporations buying territorial rights will be given the fullest opportunity to manage their affairs according to the local conditions surrounding their particular companies. The Electric Vehicle Company will lend the advantage of its three years' experience in establishing the New York cab service. The New York Electric Vehicle Transportation Company, which controls all State rights, will probably establish a post road service between New York and Albany as soon as the cabs and storage batteries can be procured. On country roads it is practicable to run the cabs at the rate of 20 miles per hour. The New York Electric Vehicle Transportation Company will not sell sub-rights, but will establish town service under its own direct management.

NIAGARA GORGE ROAD.—On March 15th, $950,000 worth of bonds of the Niagara Falls & Lewiston Railroad were sold in New York for 50 cents on the dollar. They were 30 year, 5 per cent. gold bonds, first mortgage, due in June, 1925. The bonds had been held as security by the Equitable Life Assurance Society for a note for $760,000. The railroad interested is better known as the Gorge road of Niagara. All winter long it has been idle and the cars have stood unused in the barn, a receiver being in charge of the property. The future of the road is uncertain. In some circles it is intimated that the New York Central will become the owner, while others say the road will finally turn up as a part of the possessions of the International Traction Company, the new name for the $25,000,000 syndicate that has purchased the electric roads of Buffalo, Niagara Falls and vicinity. The only reason why the New York Central should buy it would be to do away with a very active competitor in the Niagara gorge travel and to gain possession of additional rights along the bank and shore of the Niagara gorge. To the International Traction Company it would be equally valuable, as forming a part of their apparently contemplated belt line in and about the gorge. It is very evident from the condition of the roadbed at present that no matter who becomes the owner, a vast amount of repair work will have to be done before the line can be operated in the spring.

THE WEEK was one which was marked by heavy realizing in industrials and closed with great strength in railroad securities. Money was in active demand, but the bank statement showed that easiness could be expected and that there would continue an abundance for all legitimate purposes. Throughout the country wages were advanced, and great activity in retail trade was reported. The wheat crop is backward and prices have been firm to high. In iron and steel, there is evidence of a shortness of supply, and all stock in sight may be said to be engaged for months to come. Copper has sagged off, and the speculation in copper mines is less buoyant. The week saw a general decline of values in that field. During the week Western Union Telegraph was steady around 93⅞; General Electric closed at its highest at 118⅞, and Metropolitan Street Railway ran up to 256½. American Bell Telephone in Boston closed at 365; Erie, at 95 to 96; New England, at 147 bid; Boston Elevated, 97¼, and West End preferred 113; common, 94. In Philadelphia, Electric Storage, common and preferred, closed at 167 and 167¼; Electric Vehicle, common, 120½, and preferred, 151. Throughout the country traction stocks were strong and closed generally 4 or 5 points higher. Among "industrial" securities in New York, Electric Vehicle held public attention, and at one time the common sold as high as 142, but by Saturday it sold off to 110. There are those who expect it to go to 200, but many such fluctuations as this may be looked for.

NEW ORLEANS EDISON BONDS.—Subscription books were opened simultaneously in New York, Boston and Chicago on March 28 (closing at 3 p. m. of the same day), by N. W. Harris & Co., for $500,000 5 per cent. first mortgage gold bonds, due 1929, of the Edison Electric Company of New Orleans. The bonds are part of a total authorized issue of $2,500,000, and they were offered for subscription at 106 and accrued interest. The firm has already sold $1,200,000 of the bonds. Of the total issue of $2,500,000, bonds in excess of $2,000,000 can only be certified by the trustee as follows: $200,000 for 75 per cent. of the actual cash cost of extensions and additions, and the remaining $300,000 or 66⅔ per cent. for extensions and additions to the property, excluding any royalty charges. Provision is made for the additional investment in the property of the entire net earnings above fixed charges for the year 1899, an amount estimated at $200,000. The franchises of the company are stated to be perpetual and its equipment fully equal to the present and future needs of the city. The net earnings of the company in 1898 were $262,817, against $220,320 in 1897, and $74,150 in 1894. The earnings for 1899, as estimated by the officials of the company, should be $300,000, or a surplus of $200,000 over the 5 per cent. interest on the $2,000,000 bonds outstanding. It is stated that Mr. S. Insull, president of the Chicago Edison Company, estimates that the combined properties of the Edison Electric Company of New Orleans represent an actual cash investment of approximately $2,865,000.

THE OUTLOOK.—In their weekly review R. G. Dun & Co. remark: "Business is not frightened, either by the great capitalization of new companies or by the wild fluctuations in Wall Street. It goes ahead with calm disregard of speculative performances, and payments through the principal Clearing Houses have been for the week 78.2 per cent. larger than last year, and 80.3 per cent. larger than in 1892; but for cities outside of New York 39.2 per cent. larger than last year and 44.3 per cent. larger than in 1892. No matter how much the stock operations in New York may count, business elsewhere is large enough to warrant a wonderful expansion of industries, and that is the thing most important to observe. In no considerable branch has production diminished, but in practically all it has been increasing during the past week." Bradstreets in its report says: "Stormy weather, retarding spring distribution in some sections, has imparted an irregular appearance to general trade, while some few reductions in prices of leading staples, notably raw cotton and wool, copper, and some few other metals, serve to break the otherwise almost unvarying appearance of strength of staple values. The general commercial situation, however, continues to present much apparent strength, and the few lines that note a quieter tone of business find ready substitutes among other branches which as yet have been rather backward. The see-saw of wheat prices has been upward this week, theoretically on reports of crop damage at home and abroad, but largely owing to speculative overselling during last week's depression, which, by the way, again developed some good foreign buying. Better weather at the South and especially improved roads find reflection in a larger volume of receipts of cotton this week, and the result is a fractional shading of prices."

Special Correspondences.

NEW YORK NOTES.

MR. H. A. WAGNER, electrical engineer of the Missouri Edison Company, St. Louis, Mo., was a visitor to New York during the past week.

LOCAL SECRETARIES for the American Institute of Electrical Engineers have been appointed as follows: H. F. Parshall, London, for Great Britain; James S. Fitzmaurice, Sydney, N. S. W., for Australia; and Prof. R. B. Owens, Montreal, for Canada.

MARSHALL TELEPHONE BILL DEFEATED.—At Albany on March 22, Senator Marshall's bill regulating telephone charges was reported adversely by the Committee on Miscellaneous Corporations in the Senate. Senator Marshall in the Senate moved to disagree with the adverse report. The motion was defeated by a vote of 34 yeas to 15 nays and the bill is probably dead.

THE C & C ELECTRIC COMPANY has found it necessary, on account of a most gratifying increase in its business, to add another office room to its suite of offices in the Central Building, at 143 Liberty Street, New York, and to increase its clerical force. During the last two years the company's field has been rapidly and steadily growing until now it is doing by far the greatest volume of business in its history.

A NEW ENGINEERING FIRM.—Field & Everett is the name of a new firm of electrical and mechanical engineers, with offices in the Queen Building, 41 Cedar Street, New York. The firm is composed of Messrs. Frederick C. Field, electrical engineer, and Frank W. Everett, electrical and mechanical engineer. Both gentlemen received their technical training at the Massachusetts Institute of Technology. Mr. Field was formerly with the Edison Electric Illuminating Company, of Brooklyn, and Mr. Everett with the Union Iron Works of San Francisco.

MR. P. H. POLGLASE, who for many years was connected with the Chicago office of the old Thomson-Houston Electric Company and of the General Electric Company, and latterly with the Gamewell Fire Alarm Telegraph Company, has joined the selling staff of the C & C Electric Company, and for the present will be located in its New York office, under Mr. Campbell Scott, the company's general sales agent. Mr. Polglase has a most enviable record as a successful salesman of electrical apparatus and will no doubt be to the fore in the East as he has always been in the West.

LIMIT ON SPEED OF STREET CARS.—Corporation Counsel Whalen takes issue with the officials of the Metropolitan Street Railway Company when they assert that the municipal authorities have no control over the speed at which street cars are operated. "In March, 1897," Mr. Whalen said, "the Board of Aldermen passed an ordinance limiting the speed at which vehicles on the public streets and avenues should be operated. By the terms of this ordinance five miles an hour was established as the maximum speed to be attained by vehicles. The ordinance applies to street cars of all kinds, and if the officials of the Metropolitan Company contend that it does not they are mistaken. As it is, the police have power to enforce the ordinance, and if they fail to do so they are liable. The law is plain enough."

STEVENS BOYS IN DEMAND.—That the efficiency and capability of the men who are graduated from the Stevens Institute of Technology, Hoboken, N. J., is thoroughly appreciated by business men, has again been fully demonstrated in the fact that during the past week President Morton has received no less than five letters from prominent manufacturers asking that he recommend Stevens graduates to them for positions in their places of business. All of the positions offered were very desirable ones, the lowest salary being $1200 a year. "It is indeed very gratifying," said President Morton, "to know that the ability of our graduates is esteemed so highly. It was a surprise, though, to receive so many applications at once, and I had to do quite some thinking and make much inquiry before I could recommend the required number. You see the graduates of Stevens, as a rule, generally secure positions as soon as they graduate, and in this instance we had to recommend men who are at present employed, but who could better themselves somewhat by accepting the positions offered."

NEW ENGLAND NOTES.

MR. F. B. SMITH is in charge of the New England office of the Keystone Electrical Instrument Company, of Philadelphia, at 170 Summer Street.

MR. EDWARD L. COOLEY, who for several years has been one of the most active and successful among the salesmen of electrical machinery in Philadelphia, has severed his connection with the General Electric Company to take the position of manager of the New England office of the C & C Electric Company at 19 High Street, Boston. Mr. Cooley has a large circle of friends in Philadelphia, who will be sorry to see him leave them; yet they are much gratified at his advancement. Mr. Cooley is a native of Boston and has many old friends there ready to welcome him back, and there is every reason to believe that he will do a large volume of business for the C & C Company.

CHICAGO NOTES.

MR. G. G. LUTHY, of the Royal Electric Company, Peoria, Ill., was in Chicago last week.

THE ROYAL ELECTRIC COMPANY, of Peoria, Ill., has opened offices in the Marquette Building, Chicago, and placed it in charge of Mr. J. B. Wallace. Mr. Wallace will be assisted by Edward L. Barr and will attend to the sales of the company's apparatus in the territory, comprising the States of Ohio, Indiana, Michigan, Wisconsin and Minnesota, and Northern Illinois and Eastern Iowa.

FINED FOR NOT USING FENDERS.—The Chicago City Railway Company was recently fined $250 for running ten cars without fenders, as required by city ordinances. It is stated that the Law Department will proceed to bring suits against other companies which have not provided all their rolling stock with these life-saving devices. The ordinance provides for a fine not to exceed $100 and not less than $25.

INDIANA NOTES.

THE STAR ELECTRIC COMPANY, of Waterloo, with a capital stock of $15,000, has been incorporated by filing articles with Secretary of State.

A 50-MILE ELECTRIC RAILWAY.—The Evansville & Southern Railway Company, which proposes to build electric lines from Evansville to New Harmony, Princeton and Cannelton, has been incorporated by Dayton, Ohio, capitalists. The entire system will be 50 miles in length.

RAILWAY FRANCHISE REFUSED.—The Commissioners of Carroll County have refused to grant a franchise to the Indianapolis & Logansport Traction Company, which sought a right of way through the county over the Michigan road. The Commissioners say that local capitalists shall have the preference.

THE RICHMOND INTERURBAN RAILWAY COMPANY, with a capital of $10,000, has filed articles of incorporation with the Secretary of State. The company proposes to construct and operate street railway lines in Richmond, Centerville, East Germantown, Cambridge City, Dublin and intermediate points reaching into Ohio.

RAILWAY FRANCHISES IN MARION COUNTY.—The Marion County Commissioners have been asked for a franchise or right-of-way in the Mooresville pike to Martinsville, and Hon. Charles L. Henry, the "Electric King" of the gas-belt, petitions them for a franchise from the State Fair grounds on the Allisonville pike to the County limits. Both will probably be granted.

RAILWAY FRANCHISES.—The County Commissioners in Morgan and other counties have continued all applications for electric road franchises and will grant no more at present. The Commissioners say land-owners along the proposed routes are opposed to giving right of way on the highways. Some land-owners are willing to donate private lands but not on public highways.

DEADHEAD MUNICIPAL ELECTRIC LIGHTS.—Municipal control of electric light is not satisfactory in Crawfordsville. Last week it developed that every city employee and every employee of the plant has his house wired and had been using the light without price. The expose occasioned a breeze of indignation among the people, and all deadhead service is ordered cut off at once.

TRIALS AND TRIBULATIONS OF A RAILWAY ENTERPRISE.—Complications have arisen in the proposed construction of an electric road between Logansport and Indianapolis. It was considered probable that George P. Mareoll's purchase of the Logansport Street Railway system would lead to speedy operations of the enterprise, but obstacles in the way of securing right of way have seriously blocked the plans and the Indianapolis capitalists are discouraged. Matters have also taken an unexpected turn by the interference of Logansport capitalists who are seeking a franchise to operate a line on many of the best streets in Logansport. The Indianapolis people say it is simply a plan to hold them up for a price.

THE INDIANAPOLIS STREET RAILWAY ISSUE.—A recent meeting called by the advocates of 3-cent fares and short term street railway franchises at Indianapolis, was a tumultuous affair, and the ill-feeling came near precipitating a riot. The call and programme provided that only advocates of the measures advanced should speak. It was plain before the meeting had progressed far that the house was packed by a large number of persons who came with the intention of breaking it up. The partisan feeling pro and con relative to the above measure which the people generally are demanding, i. e., 3-cent fare and short term franchise, ran so high that it was with difficulty that the Mayor and police prevented a riot. The proceedings were interrupted throughout and an adjournment followed, since which time nothing has been done in the way of granting the franchise. The feeling of the citizens, together with the temporary injunction against the Board of Public Works has blocked everything temporarily. The company insists that it cannot give a 3-cent fare, and the people declare they will be satisfied with nothing less. Another mass meeting will be held, and in the meantime the excitement runs high.

ST. LOUIS NOTES.

THE IMPERIAL ELECTRIC INFRINGEMENT CASE.—By request of the counsel of the Imperial Electric Company, of St. Louis, the defendant in the injunction suit filed by the Edison Company, Judge Adams, in the United States Circuit Court, postponed the preliminary trial until April 11.

THE ST. LOUIS & KIRKWOOD RAILROAD.—Within an hour after accepting the $5000 bond given the St. Louis County Court by the St. Louis & Kirkwood Railroad Company, to guarantee its acceptance of the franchise granted Sept. 3, 1898, the order was rescinded. More than this, the road came near losing its franchise, but the company's attorney pleaded time to show why the road had not signified its willingness to accept the franchise by beginning work within three months after the date of its granting, as agreed in the petition. Upon the plea of the attorney the court granted a week's further time.

THE ST. LOUIS TRANSIT COMPANY.—It is reported that the Spencer combination of street car lines will soon be given the name of St. Louis Transit Company.

TO CHANGE FROM CABLE TO ELECTRIC POWER.—The bill authorizing the St. Louis Railway Company to change the motor power of the Broadway cable system to electricity received the Mayor's signature last week.

THE MICHIGAN & ST. LOUIS ELECTRIC RAILWAY.—A meeting of the incorporators of the Michigan (Ind.) & St. Louis Railway has been called to be held at Plymouth, Ind., April 11. Eastern capitalists are reported to be behind a project to build an electric railway from Goshen, Ind., via Danville, Ill., to St. Louis. Plans will be perfected at the meeting for a survey of the route. Right-of-way through Indiana counties has practically been secured.

A CHECK ON STREET RAILWAYS.—The Missouri State Senate on Thursday of last week engrossed a bill providing that no franchise for a street railway shall be granted by the common council of any city in the State, unless the property owners representing more than one-half of the frontage on the street sought to be used shall petition for its issuance.

A NEW ELECTRIC RAILWAY.—The Collinsville, Caseyville & East St. Louis Electric Railroad Company has filed articles of incorporation with the Secretary of State of Illinois. Its principal offices will be in East St. Louis. It is capitalized for $20,000, in the names of William G. Burroughs, W. M. Hueckel, D. M. Browning, Thomas Feke and T. J. Daniel.

AN ELECTRIC RAILWAY COMPANY CHANGES ITS NAME.—Permission was granted last week to the Wellston, Creve Coeur & St. Charles Railroad Company to change its name to the St. Louis & St. Charles Railway Company. The application was made by J. D. Houseman, personally, before the St. Louis County Court. He also obtained the consent of that court to a reorganization of his company.

THE PEOPLE'S RAILWAY PAYS ITS FRANCHISE OBLIGATIONS.—City Comptroller Sturgeon last week received a check for $20,000 from Mr. F. B. Brownell, receiver of the People's Railway Company, for back franchise obligations to the city. Under the provisions of its franchise the railroad company is obliged to pay to the city $2500 every six months for the privilege of using the streets. The company had been in arrears since 1893, and the money was obtained through the interposition of the city counselor since the litigation between the railroad company and the bondholders began.

THE PEOPLE'S RAILWAY TRANSFERRED TO THE BROWN SYNDICATE.—The deal by which the People's Railway is to be transferred from the hands of third mortgage bondholders to the Brown Syndicate was practically closed Friday of last week. The price to be paid for the third mortgage bonds is 92½, which would make the purchasing price $740,000. In addition Brown Brothers will assume the floating debt of the company, which is estimated at $155,000, and also the payment of the first and second mortgage bonds with interest, which will require an outlay of $1,125,000 altogether. It is estimated that to change the motive power of the road over from cable to the conduit system will cost $250,000.

WESTERN NEW YORK NOTES.

AUBURN, N. Y., CITY RAILROAD COMPANY has announced its intention to connect its tracks with those of the G. W. S. F. & Cayuga Lake Traction Company, which connection will require the construction of track from the western limit of Auburn to Seneca Falls.

THE UNION CARBIDE CO., of Niagara Falls, has received an order for 10 carloads of carbide from an acetylene gas machine company. This means 150 tons of carbide, representing over 1,500,000 cubic feet of acetylene gas. It is said to be one of the largest single orders for this substance ever placed.

THE NIAGARA FALLS & SUSPENSION BRIDGE RAILWAY COMPANY has applied to the Common Council of Niagara Falls for permission to extend its tracks through several streets in the northern part of the city, announcing also its intention to build a line outside of the city limits on Sugar Street to Lewiston Avenue, and there connecting with the present Whirlpool & Northern road, forming a belt line.

GARLAND CHAIN COMPANY.—The entire business of the Garland Chain Company of Pittsburg, Pa., has been purchased by the Oneida Community Company, Limited, of Niagara Falls, and the machinery of the plant will be moved to the latter city, where accommodations have been provided in the O. C. L. buildings on the lands of the Niagara Falls Hydraulic Power & Manufacturing Company. The addition to the business of the O. C. L. Company will result in their taking more power from the Hydraulic Power Company.

CONSOLIDATION OF ELECTRICAL INTERESTS IN TONAWANDA.—The Tonawanda Cataract Power Company and the Tonawanda Lighting & Power Company have been consolidated under the name of the Tonawanda Power Company, with these officers: President, Charles A. Sweet, of Buffalo; vice-president, George Davenport, of Boston; secretary-treasurer, DeLancey Rankine, of Niagara Falls. The directors are C. A. Sweet, E. A. Wickes, William B. Rankine, DeLancey Rankine, C. B. Hill, G. W. Davenport, J. H. Rockwell and F. S. Smith.

THE PAN-AMERICAN EXPOSITION COMPANY has made rapid progress in the matter of organization during the past week. John G. Milburn has been elected president of the exposition, and he has appointed the members of several of the important committees. Among these committees is the executive committee, which will be composed of Conrad Diehl, John N. Scatcherd, Harry Hamlin, Charles W. Goodyear, Capt. J. F. Jones, George K. Birge, Major Thomas W. Symons, E. Carlton Sprague and Robert F. Schelling. The committee organized by electing John N. Scatcherd chairman. By-laws have been adopted by the company. These define the officers and their respective duties, the various committees, and also provide for a board of women managers numbering 25. A director general and an auditor will be appointed very soon. The question of a site has been left to the executive committee.

CONTRACT FOR NEW POWER HOUSE AND DAM AT WATERPORT.—The Niagara Electric Company of Niagara Falls has been awarded the contract for building a power house and dam for the new plant of the Albion Power Company at Waterport, N. Y.; also for equipping the station, reconstructing the line, etc. The power house will contain two three-phase, 60-cycle generators, one 100-kw and one 150-kw transformers, to raise the current to 6600 voltage for transmission to Albion, a distance of seven miles. The present power house of the company at Albion will be converted into a transformer station. It is understood that the conductors of the transmission line will be of bare aluminum instead of copper. A 75-hp synchronous motor will also be placed in the Albion station. Mr. W. L. Adams will be in charge of the work. Mr. Wallace C. Johnson, of Niagara Falls, is the engineer of the Albion Power Company.

SOUTHERN NOTES.

TRANSFER OF ELECTRIC LIGHT PROPERTY.—The property of the Upper Appomatox Company at Petersburg has been purchased by Messrs. John L. Williams & Son, and Middendorf, Oliver & Co., of Baltimore. It is the purpose of the purchasers to furnish both light and power. The price paid for the plant has not been made public.

THE UNITED STATES ELECTRIC LIGHT COMPANY, Washington, D. C., held an election for officers a few days ago, and the following named gentlemen were chosen; James C. Young, president; William A. Mearns, first vice-president; W. Riley Deeble, second vice-president, and Ralph W. Lee, secretary. All of these gentlemen except the president are residents of Washington. The new owners have assumed active control of the affairs of the company.

THE DISCORD between the Newport News authorities and the Newport News & Old Point Railway & Electric Company has been harmonized. At a special meeting of the council all three of the original ordinances were re-enacted, with some important modifications, both sides making concessions. The railway company agrees to permit the paralleling of its tracks on the Twenty-fifth and Thirty-fourth Street bridges, thus waiving exclusive control of the track privileges on those structures. It also agrees to give half fares to workingmen and three-cent fares to school children between certain hours. It also agrees to double-track certain portions of its line and this will save the city the sum of $18,000 for paving.

MILWAUKEE NOTES.

THE FALK COMPANY of Milwaukee, Wis., has absorbed the Cloos Engineering Company of Milwaukee. Mr. Henry R. King retires and Mr. Jacob Cloos is retained as consulting engineer.

MR. JACOB CLOOS having disposed of his interest in the Cloos Electrical Engineering Company, of which he was general manager and vice-president, has formed a partnership with his brother George, until recently connected with the lighting department of the Milwaukee Electric Railway & Light Company, under the firm name of Cloos Bros. They will act as manufacturers' agents of heat, light and power supplies, located at suite Nos. 29 and 30 Cawker Building.

PACIFIC COAST NOTES.

ELECTRIC LIGHT PLANT FOR A NAVAL TRAINING SCHOOL.—Contracts have been closed for the erection of a Naval Training School on Yerba Buena Island, San Francisco, at a cost of about $80,000. Bids have been received for a complete electric lighting plant and wiring the building. The electric work will probably amount to about $5000.

THE EL DORADO POWER COMPANY was recently incorporated under the laws of the State of California. The capital stock is $150,000; all subscribed; principal place of business, San Francisco. The directors are: William A. Bell, of El Dorado County; Thomas Clark, of Placerville; Charles O. Richards, Gilman Lambert, Harvey A. Marvin, all of San Francisco.

A NEW OREGON TELEPHONE LINE.—The new telephone line from Bandon, Ore., to Langlois, Curry County, is in successful operation. The line is being extended from Bandon to Port Orford, and further extensions to Wedderburn and Gold Beach will be made soon. In time, the line may be extended down the coast to Eureka, Cal. The gap between Roseburg and Myrtle Point is to be closed up next summer.

ELECTRIC POWER IN STOCKTON.—Stockton, Cal., has a prospect of having a number of new industries established, as a result of the extension of the long-distance transmission lines of the Standard Electric Company, of California, to that city. A smelter and a paper mill are mentioned among other projects. The Stockton Gas & Electric Company has made arrangements to distribute a large part of the available current of the Standard Company.

TELEPHONE LINE TO THE REPUBLIC MINING DISTRICT.—The wires of the Sunset Telephone Company's system will be extended fifty miles to the now famous Republic Mining District in Northern Washington. The Postal Telegraph Company is considering the project of building a line to the new camp. The opposition telephone company, which has an exchange in Spokane, Wash., has a long-distance line to Republic in operation and does a heavy business.

EXTENSION OF THE REDLANDS TRANSMISSION SYSTEM.—The Redlands Electric Light Company, Redlands, Cal., has closed a contract with the General Electric Company for two additional 1000-hp generators for an extension of the electric power system. The new station will be located two miles above the old station, so that the same water will be used twice. The voltage on the transmission lines will be 10,000 and 50 cycles will be adopted on the system.

MEXICAN NOTES.

A STREET RAILWAY has just been completed connecting the town of Pueblito with the city of Queretaro.

NEW ELECTRIC LIGHT PLANTS.—Electric light plants are being installed at Acapulco, and in the town of San Cristobal, in the State of Coahuila. Acapulco is one of the most important ports on the Pacific coast of Mexico.

EXTENDING AMERICAN TELEPHONE LINES INTO MEXICO.—A representative of the Southwestern Telegraph & Telephone Company has been consulting with the officials of the State in reference to the matter of extending the telephone system of that company to Monterey. If the company receives proper encouragement and protection at the hands of the government, its system will be extended to all of the principal cities in Mexico.

General News.

THE TELEGRAPH AND TELEPHONE.

CHAMPAIGN, ILL.—The independent telephone exchange in this place has gone into the hands of a receiver.

OWENSBORO, KY.—The Calhoun Telephone Company is extending its line along the Owensboro road.

BLACK RIVER, WIS.—The Central Wisconsin Telephone Company has completed a line to Disco, and Black River.

BINGHAMTON, N. Y.—A new local telephone company is being organized in this city and has petitioned for a franchise.

NORTHAMPTON, MASS.—The New England Telephone Company has obtained permission to bury its wires in this place.

ASHLAND, WIS.—Business men of Ashland, Washburn, Bayfield and other Wisconsin towns are organizing a telephone exchange.

RATHBONE, N. Y.—A local telephone company has been organized here and expects to commence active operations about April 15.

McKEESPORT, PA.—The Central District & Printing Telegraph Company is erecting a new telephone building here at a cost of $15,000.

LIMA, OHIO.—The Lima Telephone Company has declared a dividend of 6 per cent. and ordered a $5000 issue of treasury stock for improvements.

UNIONTOWN, PA.—The Tri-State Telephone Company has completed its line from Connellsville to Normalville. The line will be continued to Mill Run, Indian Head and Valley Mills.

BOSTON, MASS.—The Long-Distance Telephone Company has purchased seven million pounds of copper wire for extensions which will cover nearly all the principal parts of the United States.

ST. PAUL, MINN.—The Lake Park & Ulm Telephone Company has been organized at Lake Park. Among the incorporators are R. T. Gilmore, John Nelson and T. C. Hawley, all of Lake Park.

SPRINGFIELD, MASS.—The directors of the Board of Trade in this city have voted not to endorse the telephone bill now before the Legislature, which calls for a State Commission to regulate telephones.

AKRON, OHIO.—The United States Telephone Company has been organized in this city, with a capital stock of $8,000,000, to construct an independent long-distance system between cities in Ohio and Pennsylvania.

PORTLAND, N. Y.—The Portland Telephone Company has been incorporated, with a capital stock of $15,000. The incorporators are Thomas C. Morse, George W. Fuller, Ralph A. Hall and Augustus Blood, all of Boston.

DOVER, DEL.—The Delaware Senate has killed the House bill providing that no telephone company in this State should increase its present rates. The bill provided that if the rates were once lowered they could never be increased again.

YOUNGSTOWN, OHIO.—The Central Union Telephone Company will build a line from Youngstown to Alliance. Lines will also be built from Youngstown to Ravenna, another to Ashtabula and another to Petersburg and Enon, Pa. The company has received 120 miles of copper wire for these extensions.

ALBANY, N. Y.—The Hudson River Telephone Company is improving its system in this city, and proposes to make reductions in telephone rates. The present rate for 25 to 100 messages per day is $100 a year. Under the new system the long-distance facilities will be available and the rate will be $90.

FRANKFORT, KY.—The Cumberland Telephone & Telegraph Company, of Henderson and Hopkinsville, this State, has amended its charter, increasing its capital stock from $3,000,000 to $6,000,000. This company, whose principal office is in Nashville, Tenn., is a consolidation of the Great Southern and the Cumberland Telephone Companies.

DULUTH, MINN.—A telephone franchise has been granted to Mr. R. H. Evans, of Duluth. The franchise of the Duluth Telephone & Telegraph Company expired on March 9, but the company refuses to leave the field, claiming the right to operate on the strength of a law passed by Congress some years ago, which gives telephone companies the right to maintain wires on post roads.

JOHNSTOWN, PA.—The stockholders of the Johnstown Telephone Company have decided to increase the capital stock of the company from $15,000 to $100,000. It is stated that the company contemplates making extensive improvements to its system in this city and vicinity, and branching out to connect with other independent companies in the large cities and towns.

KANSAS CITY, MO.—The Missouri & Kansas Telephone Company contemplate extensive improvements to its system during the spring. A six-wire line will be built between Kansas City and Omaha, at a cost of $75,000. Six wires will also be added to the Kansas City and Topeka line. The line to Liberty will be rebuilt at a cost of $25,000, and the service increased by the addition of four circuits.

DES MOINES, IOWA.—At the meeting of the Iowa independent telephone companies which was recently held in this city, no action antagonistic to the Bell Company was taken. A paper was read by Mr. E. H. Martin, entitled "Should we Attempt to Handle Telegraph Business in Connection with Telephone Business?" and Mr. D. M. Griswold read a paper on the question, "Are Small Exchanges Necessary?"

SANDUSKY, OHIO.—Representatives of the United States Telephone Company, recently incorporated, and the directors of the Sandusky Telephone Company held a conference with a view to arranging long-distance connections for the local lines. The United States Company recently assumed control of the Ohio Independent Telephone Toll Line Company. It claims to have already secured 5,000 contracts in Cleveland.

KANSAS CITY, MO.—Mr. W. H. Alley has petitioned for a telephone franchise in this city, making three franchises of this character now before the Council for its consideration. The latest petitioners agree to provide the city government with fifty telephones free of charge; to charge $48 per year for business instruments and $30 a year for residences, and the company agrees to pay the city annually 3 per cent. of its gross earnings, such sum never to be less than $2000 a year.

ELECTRIC LIGHT AND POWER.

MONTELLO, WIS.—Fire on March 13 destroyed the electric light plant in this place.

SANTA ANA, CAL.—The San Gabriel Electric Power Company has applied for a franchise to operate an electric light plant in this town.

ABILENE, KAN.—Mr. C. W. Parker is installing an electric light plant in the city of Enid, Okla., and expects to have it in operation about April 15.

TRENTON, N. J.—The Wrightstown Water, Electric Light & Sewer Company has been incorporated at Wrightstown, Burlington County, N. J., with a capital stock of $5000.

AKRON, OHIO.—The Akron Light, Power & Traction Company will bid in the Akron Street Railway & Illuminating Company's property when it is sold. The old bondholders will be paid in stock of the new company.

GUTHRIE, OKLA.—A charter has been granted to the Chandler Cotton Oil Company, which will conduct an electric light and power business in addition to the manufacture of cottonseed oil, etc. The capital stock is $50,000.

AUBURN, N. Y.—The Universal Light, Heat & Power Company has been organized in this city, with a capital stock of $50,000. The directors are R. H. Huntington, of Watertown; and J. E. Ratchford and James Devin, of Syracuse.

GALESBURG, ILL.—The plant of the Galesburg Electric Light Company has been sold to a Portland (Me.) syndicate. The only gentlemen known here in connection with the transaction are Edward Woodman and G. F. Duncan, of Portland, Me.

WYMORE, NEB.—The Wabaska Electric Light Company, which furnishes light to this city and Blue Springs, is to be sold to local capitalists for $37,000. The new company intends to build a power house at Holmesville, five miles up the river, where generators will be driven by water power.

ALBANY, N. Y.—A bill has been introduced in the Legislature to incorporate the High Falls Electrical Company of High Falls, Ulster County, N. Y. The company is authorized to construct dams on Rondout Creek or any of its tributaries, and to build reservoirs, etc. The capital stock is to be $150,000.

TRENTON, N. J.—The Spring Lake Electric Light, Heat & Power Company of Spring Lake, N. J., has filed articles of incorporation, with a capital stock of $50,000. The company will also operate in other points in south New Jersey. The incorporators are James E. Hayes, Camden; G. H. S. Young, Philadelphia; John M. Foultz, Fraser, Pa.

LITTLE ROCK, ARK.—The Little Rock Edison Light & Power Company and the Consumers' Light & Power Company have been consolidated, the former being absorbed by the latter. The aggregate capital stock is $2,500,000. Mr. W. A. Badger, general manager of the Little Rock Traction & Electric Company, becomes general manager of the new company.

HOBOKEN, N. J.—The North River Light, Heat & Power Company has commenced the work of building its new power plant at Bloomfield and Fifteenth Streets. It is expected that the building will be ready within two months. The North Hudson Electric Company has also broken ground for a large addition to its present plant to provide room for extensive improvements.

PETALUMA, CAL.—The Clear Lake Electric Power Company, which is seeking a franchise in this place, expects to supply light and power to several other towns. The company's capital is $2,000,000. Richard Wylie, of Napa, is president, and E. H. Winship, general manager. The company has acquired a large tract of land on Cache Creek, Lake County. A reservoir will be located 162 feet above the level of the creek and at this point power will be generated. The company expects to generate electric current at 40,000 volts.

PATERSON, N. J.—The Hawthorne Heat, Light & Power Company has been incorporated by Messrs. Irvy Myers, Adam Vreeland, William H. Post, Samuel Van Blarcom, James E. Barker and L. J. Jones, all of North Paterson. The capital of the company is $10,000, and the principal office will be in North Paterson. The objects of the organization are to erect and operate electric light and gas plants, furnish electricity and gas, manufacture electrical machinery, build and operate water powers. There is some speculation as to the real object of this new company, as those on the outside do not understand why such a concern should be located in a village like North Paterson.

TACOMA, WASH.—Applications have been made for franchises to bring electric power from Lake Tapps to the city limits; to extend the street railway system to American Lake, and to connect the same with the American Lake line. The street railway company is represented by Mr. Frank Dane, local superintendent, and the power scheme is under the management of Mr. J. C. Conduit, the local representative of the Westinghouse Electric & Manufacturing Company. According to the plans, 40,000-hp will be developed and this can be increased, when necessary, to 100,000-hp or more. An expenditure of $1,000,000 will be necessary, and this will furnish power for a manufacturing population of half a million people.

THE ELECTRIC RAILWAY.

CHESTER, PA.—The Chester Traction Company has decided to introduce automatic electric signals along its road from Darby to Wilmington.

RACINE, WIS.—The Belle City street car system, it is stated, has passed into the control of the Milwaukee Street Car Company.

HOOSICK FALLS, N. Y.—The Bennington & Hoosick Valley Railroad Company will extend its lines from Hoosick to Lansingburgh by way of Pittston, Valley Falls, Schagticoke and Melrose. The proposed extension will be twenty-five miles long.

WARREN, OHIO.—The Brookfield Railroad Company, of Brookfield, Ohio, has been organized by James W. Rose, William G. Rose, Reese J. Erman, John J. Davies and Thomas H. Gilmer, to operate a road by steam or electricity between the line of Brookfield Township to the Mahoning road.

HARRISBURG, PA.—The Coke Belt Street Railway Company has been granted a charter to run through Fayette and Westmoreland counties. The road will be thirty miles in length. The capital stock is $600,000 and the directors are J. E. Weller, and Bryan Robertson, of Pittsburg; F. S. Young, of Wilkinsburg, and D. I. Shaw, of Pittsburg.

PEORIA, ILL.—The Peoria & Pekin Traction Company has sold its line in South Peoria to the Central Railway Company.

XENIA, OHIO.—A franchise has been granted to the Dayton & Eastern Traction Company for a street railway in this city.

ALBANY, N. Y.—The directors of the Albany, Helderberg & Schoharie electric railway have voted to increase the company's capital stock from $300,000 to $1,250,000.

SALINE, MICH.—The Township Board has granted a franchise to Capt. E. P. Allen, of Ypsilanti, to extend the proposed Ypsilanti & Saline Electric road through the township.

WILMINGTON, DEL.—The Wilmington & New Castle Electric Railway Company has extended its road to Delaware City and will establish a summer resort on the river somewhere near that point.

FORT WORTH, TEXAS.—An application for a receiver of the City Street Railway Company of Fort Worth has been filed and a temporary injunction granted preventing a forced sale of the property.

SARATOGA, N. Y.—The Saratoga Traction Company has been granted a franchise by the Ballston Village trustees to build and operate an electric railway in Ballston. It is expected to have the road completed by July 1.

CHILLICOTHE, OHIO.—The Chillicothe, Bainbridge & Hillsboro Electric Railroad Company has been incorporated, with a capital stock of $1000, to build an electric railway from Chillicothe to Hillsboro. The incorporators are J. K. Duffy, T. S. Mitchell, J. F. Harmon, Samuel Ryland and F. C. Jeffreys.

AUSTIN, TEXAS.—A New York Syndicate has purchased and consolidated the three electric street railway lines, two electric light and power plants and the gas plant at San Antonio, Texas. The consolidated interests will be conducted under one management and $400,000 will be expended in improvements.

MARQUETTE, MICH.—Mr. W. F. Taylor, representing Stone & Webster, of Boston, has been granted a franchise to build and operate an electric railway between Houghton and Hancock. A survey of the new line will be pushed vigorously, and it is the intention to break ground on construction work on May 1, if possible.

FINDLAY, OHIO.—The Findlay Street Railway Company is making preparations to build the long-contemplated line to Fostoria. Arrangements for this line were all made in 1892, but the panic caused a postponement. It is expected that a line will be built from Bowling Green to Fostoria, thus establishing a through line from Findlay to Toledo.

OXFORD, OHIO.—The Richmond, Oxford, Reily & Cincinnati Electric Railroad Company has been organized. A survey of the road will be made at once. The directors are M. T. Morris, Shannon; S. E. Frye, St. Charles; Dr. H. H. Smith, Reily; Dr. G. F. Cook and C. A. Shera, Oxford; R. J. Brown, Morning Sun, and Dr. Lorimer, Fairhaven.

BUFFALO, N. Y.—The Union Station Railway Company has been incorporated, with a capital stock of $60,000, to operate a line six miles long between this city and West Seneca. The directors are Lewis Stockton, William C. Cornwell, H. H. Littell, F. C. M. Lautz, T. Guilford Smith, Frank B. Baird, Frank H. Goodyear and W. Caryl Ely, of Buffalo; and George Urban, Jr., of Cheektowaga.

CINCINNATI, OHIO.—The Richmond & Cincinnati Interurban Railway Company has filed articles of incorporation. It is the purpose of the company to take immediate steps toward building an electric road between Richmond and Cincinnati, by way of Scipio. The officers of the company are Benjamin Starr, president; B. F. Wissler, vice-president; John H. Rolling, secretary, and J. W. Barnes, treasurer.

LINDEN, MICH.—A franchise has been granted by the Linden Village Council to the Michigan Electric Railway Company to construct an electric railway through this place eastward, connecting Fenton, Long Lake, Holly, Clarkston, Pontiac, and westward connecting Argentine, Byron, Durand, Bancroft, Corunna, and other places. The route already laid out is 87 miles in length, and it is estimated that the construction of the road will cost $800,000. At Pontiac it will connect with the Pontiac and Detroit road.

KENOSHA, WIS.—The new management of the Milwaukee, Racine & Kenosha Electric Railway Company has announced that in the future the practice of stopping cars on signals will be discontinued. Several stations will be established along the line where regular stops will be made. This order has aroused a great deal of opposition among the farmers and they are preparing a protest. The action of the company is taken for the purpose of reducing the running time between Milwaukee and Kenosha.

MINEOLA, L. I., N. Y.—The Nassau Belt Line Traction Company has been incorporated at Albany, with a capital stock of $300,000, for the purpose of operating a road thirty miles long from Mineola to Long Beach, in Nassau County. The principal office of the company will be in Hempstead, L. I. The directors of the company are Henry L. Nichols and Fred Ingraham, Hempstead; J. W. Denlott, C. L. Wallace and P. K. Ames, Rockville Centre; W. G. Miller, S. R. Smith and H. P. Libby, Freeport, and Austin Cornwell, Oceanside.

NEW YORK, N. Y.—All the property of the Brooklyn & Brighton Beach Railroad Company, with the exception of an hotel at Sheepshead Bay, has been sold under foreclosure proceedings to former Lieut.-Gov. Sheehan, who represents the Flower holdings in the Brooklyn Rapid Transit Company. The price paid was $711,000. The old Brighton Beach road, which is now leased to the Kings County Elevated road, and the Brighton Beach Hotel thus become a part of the Rapid Transit system. It is intended to equip the road with electric power in time for next summer's traffic.

LITERARY NOTE.

ST. GEORGE MIVART'S discussion of The New Psychology, which is the leading article in "The Living Age" for March 25, aims to show that there really is nothing in the new psychology which is newer than Aristotle. Robert de la Sizeranne's essay on Caricature, which "The Living Age" has translated from the "Revue des Deux Mondes" is an extremely brilliant and exhaustive survey of the history and methods of caricature, from the pen of one who never writes without a complete mastery of his subject.

OBITUARY NOTES.

WARREN GREEN.—The death was announced last week of Mr. Warren Green, son of the late Dr. Norvin Green, president of the Western Union Telegraph Company. His home had been in the South. He was an inveterate first-nighter, and being a colossus, of over six feet and proportionately broad, a special seat had been built for him at the theatre. He was well known in New York.

H. B. SHALLENBERGER, widely known for his experiments with the Roentgen X-rays and other electrical work, died on March 11, at Kissimmee, Fla. He had gone South hoping to benefit his health. H. B. Shallenberger was the youngest son of Dr. A. T. Shallenberger, of Rochester, Pa. For several years he was associated with his brother, the late O. B. Shallenberger, of the Westinghouse Company. He was a brother of H. W. Shallenberger, M. D., and Mrs. A. A. Atterholt, of Rochester, and a nephew of Hon. W. S. Shallenberger, second assistant postmaster general. He was a member of the First Baptist Church, of Rochester, Pa. Some of his work was familiar to the readers of this journal.

PROF. WIEDEMANN.—A special cable despatch from Leipsic, on March 24, announces the death of Prof. Gustave Wiedemann, so well known in scientific circles throughout the world. He was born in Berlin, Oct. 2, 1826. He took up the study of physics and chemistry early in life. In 1850 he established himself as a private teacher of physics, and four years later he became Professor in Ordinary of Physics at the University of Basel. In 1863 he was an instructor in the Carolinum Technical Academy at Brunswick, and in 1866 Professor in the Technical Academy at Karlsruhe. In 1871 he became Professor of Physical Chemistry, and in 1887 he was appointed Professor of Physics in the University at Leipsic. Prof. Wiedemann's researches generally related to the science of electricity and magnetism. He published several books on scientific subjects, including "Die Lehre von der Electricitat," in four volumes. He edited the "Annalen der Physik und Chemie," which was founded in 1790, and which in recent years has been popularly known as "Wiedemann's Annalen."

LEGAL NOTES.

WESTINGHOUSE VS. WESTERN ELECTRIC.—A suit has been brought by the Westinghouse Electric & Manufacturing Company against the Western Electric Company for alleged infringement of United States patent No. 573,009 on dynamo electric generators, granted Dec. 15, 1896, to B. G. Lamme, and relating to machines of the booster type.

SUIT FOR DAMAGES TO WATER PIPES BY ELECTROLYSIS.—The City of Dayton, Ohio, has brought suit against the City Railway Company of Dayton for $45,000 for alleged injury to the water pipes through the negligent management of the current used by the railroad company. Some time ago a similar suit was brought against the People's Railway Company for $25,000.

CONTRIBUTORY NEGLIGENCE.—The Indiana Appellate Court has reversed a judgment for $1500 recovered against the Citizens' Street Railway Company of Muncie. Plaintiff was driving along the street when he met a street car. He turned to cross the track in front of the car when it was so close that it struck his horse before it had stepped across the first rail. The horse was knocked backward into the buggy, and both were carried a hundred feet and plaintiff seriously injured. The court said that while the street car was probably running faster than it ought to, and not properly under control, plaintiff did not act with prudence in trying to drive in front of it when it was so close, and is not entitled to recover because of contributory negligence.

THE CARTY PATENT.—Argument was heard in Philadelphia recently by Judges Acheson, Dallas and Kirkpatrick, in the United States Circuit Court of Appeals on the appeal of the Millheim Electric Telephone Company and others, of Millheim, Pa., from the decision of Judge Buffington, in favor of the Western Electric Company, of Chicago. Under the finding of the lower court, it was held that the patent issued to J. J. Carty for improvements in telephone circuits and apparatus, known as the "bridging bell" patent, was valid, and that the defendants had infringed the same. The defenses are that the alleged improvements claimed in the patent did not amount to a patentable invention and that it had not been infringed. Decision was reserved. The full text of Judge Buffington's opinion is given on page 126, "The Electrical World," July 30, 1898.

TELEGRAPH COMPANY LIABLE FOR CORRECT TRANSMISSION OF TELEPHONE MESSAGES.—The Indiana Supreme Court in a recent decision of a cause brought by Edgar E. Todd against the Western Union Telegraph Company, held that a telegraph company which makes a habit of receiving messages by telephone for transmission over its wires is liable to the same extent for a negligent error in writing out and transmitting such a message as it would be if the message, properly written, had been handed into its office. A message notifying Todd of the death of his father was read to the telegraph agent over the telephone, who repeated it correctly, but afterwards wrote and sent the message to "Pott" instead of Todd. A judgment for $200 is affirmed. The court says there is no legal obligation of the company to accept messages over the telephone, but if it does so the company is responsible for the requisite precision to insure correct transmission.

PERSONAL NOTES.

MR. P. YENSEN has been appointed general manager of the Cleveland Telephone Company.

MR. J. P. McKINSTRY has been elected vice-president of the Southwestern Telegraph & Telephone Company and Northwestern Telephone Exchange Company.

GEN. IRVING HALE, who formerly represented the General Electric Company in Colorado, is reported slightly wounded in the recent fighting outside of Manila. He is an old West pointer, with a fine record in and out of the army.

MR. ALFRED DOLGE, the well known felt manufacturer and philanthropist, founder of the interesting town of Dolgeville, N. Y., is now to become manager of a large felt-making concern in Chicago, in which Mr. P. D. Armour is said to be interested. There is a host of friends in the electrical field who will wish Mr. Dolge a return of prosperity in fullest volume.

MR. JOHN KRUESI.—In regard to the death of Mr. Kruesi the General Electric Company has adopted the following resolution: "The Board of Directors of the General Electric Co. desires to record its sense of the company's great loss by the death of Mr. John Kruesi, who was one of the founders of the industry in which the company is engaged. Mr. Kruesi's ability and singular devotion to duty have always been important factors in the company's success, and the solidity of his character, as well as his unfailing courtesy and kindness of disposition, have greatly helped the company to retain the confidence and support of those having business relations with it. In transmitting a copy of this record to Mr. Kruesi's children, the secretary of the company is desired to express to them the directors' heartfelt sympathy in their loss, and the warm personal esteem in which Mr. Kruesi was held by every member of the board, as well as by all his associates."

Trade and Industrial Notes.

THE ROYAL ELECTRIC COMPANY, of Peoria, Ill., has prepared a new price list on its standard and special transformers, a copy of which will be sent to the trade on application.

THE SMITH & HEMENWAY COMPANY, 20 Warren Street, New York, has purchased the entire hardware business, good will, trade mark, etc., of Maltby-Henley Company at the same address.

THE SIEMENS & HALSKE ELECTRIC COMPANY has just shipped to Mexico three generators and twelve motors, which will be used in the operation of the new machine shops of the Mexican International Railroad at Ciudad Porforio Diaz, Mexico.

MR. H. J. GORKE, Syracuse, N. Y., has leased the store 305 South Clinton Street, where he will carry a complete line of all electrical appliances known to the art. Mr. Gorke has made this change in order to increase his store capacity and keep abreast of the times.

THE FOSTORIA BULB & BOTTLE COMPANY, Fostoria, Ohio, is now in process of organization for the purpose of manufacturing incandescent lamp bulbs and other glass products. The company has received a cash bonus of $2000 and two acres of ground and a building.

THE OHIO ELECTRIC WORKS, Cleveland, Ohio, will, on April 1, move into their new building at the corner of Allen, Gordon and Franklyn Avenues on the west side of the city. The new factory is equipped throughout with modern machinery and appliances, and is four stories high.

MR. E. K. CONOVER, of the Conover Manufacturing Company, 26 Cortlandt Street, New York, has just returned from a five weeks' trip to Cuba. Mr. Conover reports excellent business as the result of his trip. He installed Conover Condensers in several lighting stations in that island.

FIRE.—The works of the Cleveland Machine Screw Company, on Perkins Avenue, Cleveland, Ohio, where the metal stamping branch of the business was carried on, were destroyed by fire on March 24, entailing a loss estimated at $50,000. These works did not constitute the main plant of the company.

THE INTERSTATE ELECTRIC COMPANY is the name of a new concern organized at Cleveland, Ohio, for the purpose of dealing in electrical machinery. The capital stock is $20,000 and the names of the incorporators are Fred Haffner, Master Roach, John G. Haffner, all of Cleveland, and others.

MAJOR R. J. RANDOLPH, of the Sterling Arc Lamp Company, 214 West Twenty-sixth Street, New York, has just returned from a three-months' business trip covering the entire Southern and Western States. The Major reports a very successful business on his tour, and the sales of Sterling lamps increasingly large.

THE ELECTRIC APPLIANCE COMPANY, Chicago, reports very large sales of the P. & S. junction box, which is an all porcelain box for high voltage service. The P. & S. box seems to meet all requirements and finds a ready sale wherever introduced. The Electric Appliance Company carries a large stock of these goods.

THE SARGENT AUTOMATIC RAILWAY SIGNAL COMPANY has been incorporated at Trenton, N. J., with a capital stock of $2,000,000. The company is empowered to manufacture and deal in railway semaphore signals. The incorporators are: James Sargent, John D. MacMaster, E. B. Fenner, and P. L. Koscialowski, all of Rochester.

THE NATIONAL AUTOMATIC FIRE ALARM COMPANY, OF LOUISIANA, 614-618 Gravier Street, New Orleans, La., has issued a revised price list of Edison phonographs and accessories. On the face of the card are printed, in large type, the words "keep-a-movin'" and the picture of a tramp obeying the injunction. A ferocious bull dog in the rear urges him along.

SPECIALTY MANUFACTURING COMPANY, 361-367 Meridian street, Indianapolis, Ind., in a little pamphlet describes and illustrates its "Triumph" exhaust fans, ceiling fans for belt power, water motors, etc. The Triumph water blow fan is suitable for operating telephone generators and for other light powers. It operates successfully with 1-16-inch jet on all pressures of 50 pounds and upward.

THE MARITIME IMPROVEMENT COMPANY has been incorporated at Trenton, N. J., with a capital stock of $3,000,000, with authority to build canals, docks, and construct electric-light, gas, telephone, and telegraph plants. The incorporators are: Charles H. Cramp, Philadelphia; Gustave Lindenthal, New York; Chauncy H. Dutton, New York; Amzi L. Barber, New York; E. F. C. Young, Jersey City.

THE NATIONAL SUPPLY COMPANY has been incorporated at Trenton, N. J., by Messrs. Frank S. DeRonde, of Englewood; John J. Muirheid and John A. Hall, of Trenton. The capital stock is $125,000. The National Supply Company will deal in all kinds of electrical apparatus. Mr. DeRonde is well known to the electrical trade through his connection with the Standard Paint Company as general sales manager.

MR. LEITER'S AIR CABS IN ENGLAND.—Joseph H. Leiter will go to London shortly to organize there a company to operate air power cabs and omnibuses. The company will be named the London Auto-Truck Company, and will be capitalized at $25,000,000. It is understood that the vehicles will be operated by the Hoadley-Knight system of compressed air, which is controlled by the International Power Company, and which at present has not a single vehicle operating in America.

THE WALKER COMPANY'S plant in Cleveland, Ohio, has undergone a considerable change since the purchase of that company by the Westinghouse Electric & Manufacturing Company. Very little electrical work is now done at the plant in this city, most of it having been transferred to Pittsburg, and considerable of the machinery, such as drills, planers, etc., has been shipped to the Westinghouse works. The employees, 150 in number, have either gone to Pittsburg or have found other employment in the city.

THE VIADUCT MANUFACTURING COMPANY, Baltimore, Md., reports that it is turning out large quantities of its regular telephone sets and great numbers of standard magneto bells to the trade. Its factory is running full time on telephone work, district telegraph messenger call boxes, and on specially constructed telephones for railway use. Since the consolidation of a great many of the street railways, it has been found important to have a good signal apparatus to facilitate the movement of cars, and this company supplies a very superior outfit for the purpose.

COLUMBIA AUTOMOBILE CO.—A certificate of incorporation has been filed with the Secretary of State at Trenton, N. J., by the Columbia Automobile Company of New York, with a capitalization of $3,000,000. The incorporators are: William B. Greeley, New Rochelle, N. Y.; Charles A. Mendell, New York; Linley M. Garrison, Jersey City; Elliott Mason, Andrew H. Scoble, Louis R. Moore, Anthony N. Jeshera, John M. Scoble, Sherman M. Granger, Francis R. Foraker, all of New York; Charles G. Hill, of Newark, and Roland B. Harvey, of New York. It is understood that this is a Pope organization.

SOME ELECTRICAL PROSPERITY.—The Western Electric Company of this city, which is controlled by the American Bell Telephone Company, and manufactures all the telephones used by the latter and its sub-companies, is unable to meet the demand upon it for telephone apparatus, notwithstanding its plants are running night and day. The Western Electric received last month orders for 65,000 telephones, or 15,000 more than its monthly capacity. It now employs 2700 hands, and will increase the number to 3000. Recently it purchased real estate in this city for $475,000, and will expend $500,000 erecting a building on the newly-acquired ground. It is now constructing a building in New York at a cost of $550,000.—*Chicago Journal.*

NEW FACTORY OF THE NORTH ELECTRIC COMPANY.—The North Electric Company, of Cleveland, Ohio, announces its removal from its old quarters on South Water Street to its fine new factory in the H. B. Perkins power block, 61 to 73 Frankfort Street. The new factory comprises the entire sixth floor, with over 12,000 square feet. It is equipped throughout with modern appliances and machinery, for manufacturing a full line of telephone apparatus, including switchboards, magneto bells, etc. It is said to be one of the largest telephone manufacturing establishments in Ohio. Mr. C. H. North, for fourteen years identified with telephone interests, is president of the company. Mr. George C. Steele, a well known Cleveland business man, is secretary and treasurer.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., has made arrangements with the Emerson Electric Manufacturing Company for the sale of its motors during this season. The established reputation which the Emerson Company enjoys is due to its efforts to maintain strictly high-grade products. Its '99 Model, among other improvements, has an entirely different blade from the one formerly used. The blade cuts the wind without causing the incessant buzzing which is so common with many desk fans. The Western Electrical Supply Company is in position to make prompt shipments of these fans and anticipates a very large fan motor business this season. It is again introducing its Paragon fan which met with success last season. The Paragon fan is made only for direct current, whereas the Emerson fan is made only for alternating. These two fans make a good combination to handle. The new type Paragon ceiling fan promises very flattering returns during the coming season.

THE WESTINGHOUSE MACHINE COMPANY, Pittsburg, Pa., has issued a very attractive catalogue of its standard engine. This well known machine has been on the market for eighteen years. The company is to-day building more of these engines than ever and building them better in every point where the experience with nearly 5000 engines of this particular type has indicated that improvement was possible. The field of application of the Westinghouse standard engine embraces every location in which the use of a simple non-condensing engine is consistent with the principles of sound engineering and commercial economy. The details of construction of the engine are very clearly described and some excellent half-tone illustrations represent the engine complete and in its details. Standard engines for direct connection to electric generators are supplied either in "Kodak" type or engine type. The company has accumulated a line of patterns for bed plates and bearings which enable it to promptly meet the requirements of any sizes and every well known make of generator.

THE BELKNAP MOTOR COMPANY.—Mr. George W. Brown, president and general manager of the Belknap Motor Company, of Portland, Me., resigned the position of general manager on March 1 last. Mr. Brown, however, still remains connected with the company as president. Mr. E. E. Fernald, who has been with the company for some years, takes Mr. Brown's place as general manager. The company is at present rushed with orders, especially for its voltage regulators. It has recently shipped two regulators of 500-kw capacity to the Northern Electric Manufacturing Company, and the Pennsylvania National Heating & Power Company of Philadelphia, by order of the Stanley Electric Manufacturing Company, of Pittsfield, Mass. It has also shipped one to the Montmorency Electric Power Company, Quebec. Five of these regulators have been placed within a short time with the Buckeye Electric Company, Cleveland, Ohio, and the Belknap Company has recently shipped others to the Belle Plaine Electric Light Company, Belle Plaine, Iowa; the Fort Wayne Lamp Company, Fort Wayne, Ind.; the town of Hope, Ark.; John J. Berger, Troy, N. Y.; J. F. Viles, Middlesex, Vt., and it has numerous other orders on hand.

THE STILWELL-BIERCE & SMITH-VAILE COMPANY, of Dayton, Ohio, has been awarded a $30,000 contract for water wheels to run the electrical machinery for opening the lock gates on the Soulanges Canal, Canada.

THE CASE MANUFACTURING COMPANY, Columbus, Ohio, has lately shipped a 15-ton electric traveling crane to St. Petersburg, Russia, for use in a new port at that place; also two 30-ton three-motor electric traveling cranes for use in the government power station at Sydney, New South Wales.

BUSINESS NOTICE.

MANUFACTURERS OF ELECTRICAL GOODS of any description not represented by agencies in New England, will find it to their advantage to communicate with the Central Mfg. Co., which is to open an Electrical Supply house about the 15th of April. Central Mfg. Co., 10 Central Street, Boston.

Record of Electrical Patents.

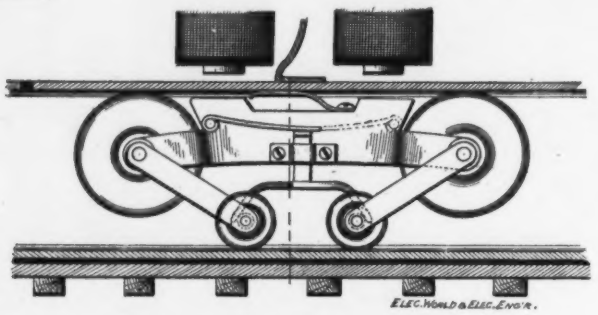
UNITED STATES PATENTS, ISSUED MARCH 21, 1899.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

621,321. ELECTRIC RAILWAY SYSTEM; Geo. L. Campbell, Dushore, Pa. App. filed May 5, 1898. A magnet on the vehicle attracts and carries along, a small trolley moving in a closed conduit, the trolley automatically switching the current from section to section.

621,346. AUTOMATIC TELEPHONE SWITCH; C. S. Karoly, of Aurora, Ill. App. filed Nov. 9, 1897. The invention, which consists of the details of construction, is intended to provide an arrangement with which a call and return or answer call, can be quickly made without the intervention of the central office.

621,352. SUPPLY OF CURRENT TO AND GOVERNING ARC LAMPS; F. M. Lewis, of London, Eng. App. filed Dec. 28, 1897. The invention is based upon the employment of a device, which, while performing the functions of a transformer in changing the alternate pressure of the current supplied from the mains, at the same time performs the function of striking the arc and regulating the distance between the carbons during burning.



No. 621,321.—Electric Railway System.

621,361. ELECTRIC BURGLAR ALARM SYSTEM; D. W. McCaughey, of Chicago, Ill. App. filed April 1, 1897. It is proposed to combine with the usual contact points on windows and doors, one or more circuits so divided that each portion of the circuit has one or more resistance coils. The total resistance, however, is always equal on each circuit, and if one or more of the circuits are short circuited the resistance becomes unequal and acts to sound an alarm.

621,399. TROLLEY; A. J. Young and C. L. Magune, Rockland, Me. App. filed Dec. 6, 1898. In accordance with this invention the trolley head, which bears the trolley-wheel, projects upwardly and rearwardly from the pole at an oblique angle; said head is swiveled to the pole, and means are provided for guiding and controlling its position, and in constructing said head it will be formed or provided with a spindle which enters a hole in the pole, and to augment the obliquity of the trolley-head and assist it in performing its functions, its spindle is also disposed more or less obliquely to the pole.

621,412. TRANSFER WATTMETER SWITCH FOR STORAGE BATTERY CIRCUITS; Charles Hewitt, Philadelphia, Pa. App. filed May 13, 1898. (See Current News and Notes.)

621,417. ARC LAMP; E. Hungerbühler, of London, Eng. App. filed Dec. 8, 1897. This lamp has a circularly curved solenoid adapted to turn on its axis of curvature and thereby regulate the position of the carbons. The object is to reduce the space occupied by the regulating mechanism and to prevent violent oscillations at the time of striking the arc.

621,422. TROLLEY CATCHER; R. I. Kroft, of Avon Lake, Ohio. App. filed April 14, 1898. Provides an attachment whereby the action of the tension spring upon the trolley arm is overcome after the trolley jumps the wire, and the arm is drawn down and contact with the over-head system prevented until the operator again sets the trolley in position upon the wire.

621,449. TELEPHONE SWITCH; C. E. Egan, B. L. Lawton and E. C. Wilcox, of Meriden, Conn. App. filed Feb. 29, 1898. This invention relates to the armature, the hook, the drop-shutter and other parts of the spring jack and connections and means for securing the same to a switchboard.

621,471. SWITCH FOR ALTERING SPEED AND DIRECTION OF REVOLUTION OF ELECTRIC MOTORS; W. R. Edwards and S. F. Beevoir, of London, Eng. App. filed Sept. 6, 1898. Specific construction of a starting and controlling box.

621,492. ELECTRIC RAILWAY; W. J. George, of Johnstown, Pa. App. filed June 8, 1898. The invention primarily contemplates means for mounting and housing the switch plates which automatically close the circuit through the contiguous sections of the conductor.

621,523. SECONDARY BATTERY; Paul Joseph Rodolphe Dujardin, Paris, France. App. filed Dec. 29, 1897. (See Current News and Notes).

621,631. SECTION INSULATOR; E. F. Cook, of Cleveland, Ohio. App. filed March 5, 1898. An insulating block carries two metallic end pieces each of which has a wire channel, a tooth pick end and an arc preventing flange.

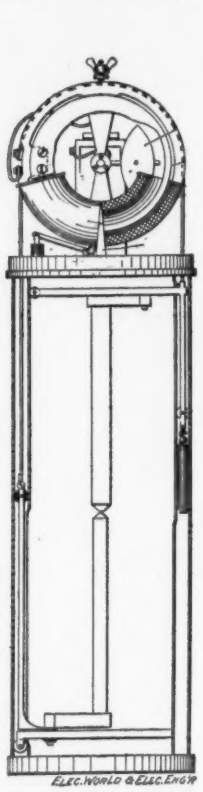
621,550. AUTOMATIC MECHANISM FOR OPENING AND CLOSING ELECTRIC CIRCUITS; J. H. Windspear and F. R. Swith, of Omaha, Neb. App. filed April 5, 1897. A sand-glass is mounted to turn on a transverse central axis; stops permit the oscillations of the glass while keeping it inclined from a vertical position. Means are provided for reversing the position of the glass and an electric circuit is arranged to be made and broken as the sand swings the vessel against one stop, when above the axis, and against the other when it has passed into the compartment below the axis.

621,561. RESISTANCE COIL; W. P. Freeman, of New York, N. Y. App. filed June 8, 1898. A resistance coil consisting of a flattened conductor extending in cylindrical form, first in one direction and then in the other, insulating material separating the successive layers and a frame in which the said conductor and insulating material are clamped.

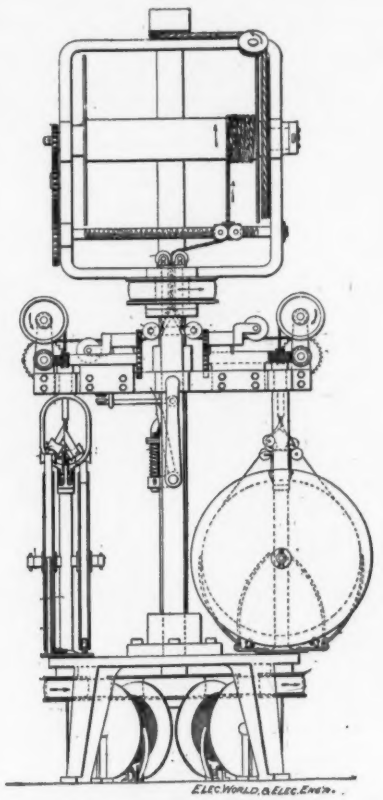
621,661. INSULATOR; M. Harloe and W. S. Bloes, of Hackville, Pa. App. filed Feb. 1, 1899. An insulator having a body portion with means for mounting it to swing, and studs formed on the body between which the wire may be bent and held, the wire being engaged with the studs by swinging the insulator first to one side and then to the other.

621,664. ELECTRIC HEATER; E. E. Gold, of New York, N. Y. App. filed Jan. 8, 1898. The resistance wire is wound in helical form and then trained around a centre and held in the latter position by a single stiff wire passing through the helix, the size of the wire being much less than the diameter of the helix, thus providing for free circulation of air within the helix.

621,716. SECONDARY BATTERY PLATE; Alexander Schanschieff and Albert Edward Hodgson, Halifax, England. App. filed Oct. 17, 1898. (See Current News and Notes).



No. 621,417.—Electric Arc Lamp.



No. 621,735.—Machine for Applying Paper or similar Insulating Material to Wire.

621,717. DYNAMO-ELECTRIC MACHINE; Coleman Sellers, Philadelphia, Pa. App. filed Oct. 20, 1897; renewed Oct. 31, 1898. Relates to the Niagara type of generator, and covers constructional details for securing proper alignment and concentricity, and also means for maintaining a cooling system within the machine.

621,733. ELECTRIC BELT; T. F. Wynne, of Lindale, Texas. App. filed Oct. 4, 1898. The invention relates to means for holding battery cells on the belt.

621,739. AUTOMATIC ELECTRIC SWITCH; R. Baumann, of St. Louis, Mo. App. filed March 10, 1898. An armature plays between the poles of a pair of magnets and actuates spring controlled levers for imparting quick movement to the circuit controlling devices.